286053

4.3 Cultural Resources

USCG-2004-16860-33

4.3.1 Evaluation Criteria

These findings are based on interpretation of side-scan sonar, magnetometer, subbottom profiler, and bathymetric data. The side-scan sonar, magnetometer, and subbottom profiler are all used to identify sunken wrecks, but the subbottom profiler is used primarily in identifying subseafloor features that would have attracted prehistoric humans to the area. This, in conjunction with geological interpretation of the last 12,000 years, was used to identify areas of high probability for human habitation.

Archaeological properties in the GOM that could be affected by the Proposed Action include inundated prehistoric sites and offshore historic shipwrecks. Any properties encountered in the survey area must be assessed to determine if they meet one or more of the criteria set forth to determine eligibility to the NRHP. Briefly, these criteria are that the resource be associated with important historical events, be associated with people who were important in history, have distinctive design or construction features, or be likely to contain data important for interpreting archeology or history.

4.3.2 Proposed Action

No effects to cultural resources would be expected. Adherence to unanticipated discovery procedures and mitigation measures would ensure no adverse effects.

4.3.2.1 General Construction and Operational Impacts

Several proposed Port activities could cause adverse impacts on archaeological resources if those resources were present. Installation of the proposed Terminal and pipelines has the potential to impact historic shipwrecks. Direct physical contact with a wreck site could destroy fragile remains such as portions of the hull, artifacts carried as cargo or for crew use, and material associated with maritime history in general. Disturbance of a site might cause the loss of the context, which is critical in assessing importance and interpretation. Pile driving for the mooring dolphins could disturb sediments for an unknown distance, disrupting stratigraphic and contextual factors. Pipeline placement and anchoring associated with its placement can cause physical impacts on prehistoric or historic archaeological resources. In particular, the burial of the pipeline and the repositioning of anchors around the pipe-laying barge can disrupt the sea floor and can impact shipwrecks directly and by disturbing associated debris.

4.3.2.2 Unanticipated Discoveries

It is possible that geomorphic features representing high-probability areas for prehistoric archaeological sites and historic shipwreck materials were not detected by the geophysical instruments or during interpretation of the data. It is also possible that the scatter of recent ferrous materials could mask buried shipwreck debris. If unanticipated archeological resources are encountered during Port Terminal or pipeline installation or maintenance area, all activity in that area must be halted. An avoidance plan for such contingencies would be prepared and subitted to USCG and MMS for review and approval. In such situations, at a minimum, a representative from the USCG Deepwater Ports office must be notified immediately and the MMS GOM Regional Office should also be notified for expert guidance in protecting the resource.

4.3.2.3 Mitigation

Terminal Area. The survey results for the subbottom profiler indicate that two generations of relict channels occur within this lease block. Further analysis of the subbottom data indicated that the margin areas of these relict channels had been heavily eroded during marine transgression. No intact landforms, such as natural levees indicative of intact prehistoric sites were observed, suggesting that these relict channel margins have low archaeological potential. Therefore, no avoidance or further archaeological study of these relict channels is recommended.

There were 34 unidentified magnetic anomalies found within the project area. Of these, 31 were interpreted as probable modern debris from previous oil and gas development to the north, or fishing activities. The remaining three magnetic anomalies, No. 18, No. 19, and No. 29, were determined to possibly represent submerged cultural resources.

MMS guidance requires a distance of 152-m (500-ft) be used to avoid Magnetic Anomalies No. 18, No. 19, and No. 29 (Branch of Environmental Assessment comments Nov 17, 2003: Archeology). If avoidance is not possible, investigation by trained archaeological divers should be carried out to ascertain the nature and historic significance of the three unidentified magnetic anomalies. Table 4-5 and 4-6 should also be incorporated into an approved anchor clearance plan to be carefully followed during construction activities in WC-213.

Table 4-5. Table of Archaeological Avoidance Areas (Magnetic Anomalies)

Ref. No.	Line No.	Shot Point	Amplitude (γ)/Duration (ft)	Area/ Block	Louisiana South		Avoidance Criteria
					X Coord.	Y Coord.	
18	153	21.31	60/150 Monopole	WC-213	1,385,208.87'	207,551.25'	152 m (500 ft)
19	181	3.82	72/134 Monopole	WC-213	1,389,811.61'	216,157.98'	152 m (500 ft)
29	212	8.9	103/354 Dipole	WC-213	1,380,445.15'	205,882.09'	152 m (500 ft)

Note: ft – feet

Table 4-6. Shortest Distance of Magnetic Anomalies to Individual Pipelines and Terminal

Anomaly Number	LNG Terminal	Proposed 30-in Pipeline	Proposed 16-in Pipeline	Proposed 20-in Pipeline	Proposed 36-in Pipeline	Proposed 24-in Pipeline
M18	3,530.9 ft	3.680 ft	3,680 ft	920 ft	840 ft	760 ft
M19	12,114.7 ft	12,600 ft	12,680 ft	9,800 ft	9,120 ft	600 ft
M29	1,081.8 ft	700 ft	1,160 ft	1,480 ft	1,600 ft	1,560 ft

Notes: in – inch
ft – feet

Seven side-scan sonar, or acoustic, anomalies were identified within the WC-213 study area. Two of these anomalies have magnetic correlates. However, all of the acoustic anomalies, including those with magnetic correlates, are interpreted as representing modern debris from fishing activities or from previous oil and gas development in this area (C&C 2003). Consequently, no avoidance or archaeological diver investigation of any of the seven acoustic anomalies is necessary.

C&C Technologies did not closely follow the reporting guidelines delineated in Appendix 2 of NTL No. 2002-GO1. C&C Technologies needs to update their table to include magnetometer tow depth in order to comply with paragraph F of Appendix No. 2 (Guidelines for Archaeological Resource Reports) in the MMS NTL No. 2002-G01. In addition, they should also include a column that shows the lease block and a column that shows the minimum avoidance distance. The MMS has produced an example of such a table in Appendix No. 3 of NTL No. 2002-G01. These revisions should be made and approved prior to offshore installation of any proposed Port components.

Pipeline Areas. Take-away pipeline A runs adjacent to but does not cross EC-64 and EC-65. Consequently a 70-m (230 ft) track line spacing was used. The cultural resources assessment for these two lease blocks is considered only a preliminary survey of submerged cultural resources. If the actual take-away pipline routes enter EC-64 and/or EC-65, it is recommended that no bottom-disturbing activity be carried out in these lease blocks until such time as an accurate, 50-m (164-ft) spaced, hazard and archaeological survey is completed and the data are analyzed for possible submerged cultural resources.

Two generations of relict channeling were observed in the subbottom record of the five proposed pipeline routes. The first generation of channeling was observed downcutting from 1.5-m to 4.6-m (5 to 15-ft) below the sea floor. A second generation of relict channeling was observed downcutting from the sea floor. The second generation relict channel margins are reported to have been severely eroded during marine transgression and, therefore, intact archaeological sites within these second generation relict channels are unlikely to be present. The margins of the first generation relict channels are reportedly intact and *in situ* archaeological sites might be present (GL 2003a). All five proposed pipeline routes bisect first generation relict channels. Construction of larger diameter pipes (e.g., 30-36 inch) would require, at minimum, a trench in excess of 5 ft in depth. Hence, it is possible that construction of some of these proposed pipeline routes would impact potentially significant prehistoric resources.

Table 4-7 shows the potential for impacts to prehistoric archeological resources given the diameter of the proposed pipeline.

It should be noted that the above table shows the minimum impact based on MMS requirements of a minimum of 36-inches burial and does not take into account operational variables during construction that might affect the precision of trenching depths during construction. Therefore, it also is possible that there could be impacts from trenching for the 16- and 20-in pipelines. In addition, hydro jetting may cause considerable disturbance to the sediment packets below the depth of the trench being cut, impacting any intact archeological sites present within a few feet of the proposed bottom of the pipeline trench. Consequently, the method of trenching employed during construction should be given careful consideration.

Avoidance of these relict channels is recommended to mitigate possible impacts on submerged cultural resources. If avoidance is not possible, diver investigation and testing would be required where the proposed pipeline center line crosses the channel margins that will be impacted.

Fugro recommends that the interior and exterior margins of these relict channels be avoided by 30 m (100 ft) during anchoring (GL 2003a). However, any anchor deployed between two interior relict channel margins has a very high probability of dragging across the archaeologically sensitive channel margins. If anchors are to be deployed between interior margins, acute attention should be paid to anchor cable catenary angles and anchor drag, and a post-construction assessment made to determine the level of impacts on these channel margins.

Table 4-7. Proposed Pipelines and the Depth of Possible Intrusion into Channel Margins

Pipeline	Depth of APE	Minimum Depth of Intrusion into Channel Margin at 5 ft below Seabed	Lease Blocks in Survey Corridor
Proposed 30-in Pipeline	5 ft 6 in	0.5 ft (6 in)	WC-213, 212, 205, 206, 195, 190, 184, 185, 168, 167
Proposed 16-in Pipeline	4 ft 4 in	0 ft (0 in)	WC-213, 224
Proposed 20-in Pipeline	4 ft 8 in	0 ft (0 in)	WC-213, 214, 215, 216, 217, 218
Proposed 36-in Pipeline	6 ft	1 ft (12 in)	WC-213, 214, 203, 215,202, 201, 200, 191, 192, 177, 176, EC-64, 65,
Proposed 24-in Pipeline	5 ft	0 ft (0 in)	WC-213, 214, 204, 203, 197, 182, 171

Notes: in - inch
ft – feet

It is recommended therefore that these first generation relict channels be avoided altogether. Exterior margins of these relict channels should be avoided by a distance of 500 ft during anchor placement. Under certain circumstances where anchoring in relict channels can not be avoided, due to their great width, interior channel margins should also be avoided by 500 ft. Fugro should prepare an inventory of these relict channels in all the pipeline routes with adequate positioning data and depths to beginning of channel margins. This table should be incorporated into an approved anchor clearance plan.

A total of 34 side-scan sonar, or acoustic, anomalies were recorded during the survey of the five proposed pipeline routes. Of these, 33 represent ferrous debris. Many of them were identified as discarded pipe and cable sections and all were typical of the debris generated by the offshore gas and oil industry in this area. The single remaining side-scan sonar anomaly (No. 116) is an acoustic reflection measuring 20 m by 5 m (66 ft by 16 ft) and possibly represents the remains of an historic shipwreck (GL 2003a) (see Table 4-8). This acoustic anomaly falls at the very edge of coverage in lease block WC-203 and is approximately 634 m (2,080 ft) from the proposed pipeline center line. It has two magnetic correlates, Magnetic Anomalies No. 211 and No. 214. These two magnetic anomalies occur on adjacent tracklines. If avoidance is not possible, archaeological diver investigation is recommended to determine the exact nature of this acoustic anomaly.

There were 870 unidentified magnetic anomalies noted within the pipeline survey area. Of these, only two (No. 211 and No. 214) were determined to be possible cultural resources (see Table 4-8). If avoidance is not possible, archaeological diver investigation is recommended to determine the exact nature of these magnetic anomalies.

Fugro states that the vast majority of these unidentified magnetic anomalies are low amplitude, short duration, and isolated anomalies. However, there is no discussion in the text regarding 19 unidentified magnetic anomalies exhibiting complex, or multi-component signatures that were documented in their magnetic anomaly table in Appendix B of their report. Table 4-9 lists these complex magnetic anomalies. Those highlighted have high amplitude and long duration signatures.

Table 4-8. Archeological Avoidance Areas

Ref. No.	Area/Block	Louisiana South		Avoidance Criteria
		X Coord.	Y Coord.	
Acoustic Anomaly 116	WC-203	1405188	219719	500 ft
Magnetic Anomaly 211	WC-203	1405355	219636	500 ft
Magnetic Anomaly 214	WC-203	1405638	219562	500 ft

Table 4-9. Unidentified Complex Magnetic Anomalies

Anomaly No.	Amplitude	Duration (ft)	Dipole Monopole	Sensor Height off Bottom (ft)	Lease Block	MMS Mandated Line Spacing	Survey Line Spacing (after centerline and two 50 m offsets)
157	8	257	Complex	15	WC-182	300	75 m (246 ft)
158	7	200	Complex	15	WC-182	300	75 m (246 ft)
204	46	1108	Complex	7	WC-171	300	75 m (246 ft)
225	4	101	Complex	13	WC-214	300	75 m (246 ft)
351	188	293	Complex	10	WC-202	300	75 m (246 ft)
418	69	162	Complex	14	WC-191	300	75 m (246 ft)
431	34	283	Complex	11	WC-201	300	75 m (246 ft)
455	190	265	Complex	14	WC-191	300	75 m (246 ft)
544	5	154	Complex	17	WC-177	300	75 m (246 ft)
547	742	527	Complex	14	WC-177	300	75 m (246 ft)
692	20	136	Complex	13	WC-214	300	75 m (246 ft)
755	128	201	Complex	9	WC-216	300	75 m (246 ft)
916	268	262	Complex	12	WC-185	300	75 m (246 ft)
1031	1586	392	Complex	8	WC-212	300	75 m (246 ft)
1055	670	234	Complex	8	WC-206	300	75 m (246 ft)
1106	82	225	Complex	9	WC-168	300	75 m (246 ft)
1192	230	107	Complex	9	WC-168	300	75 m (246 ft)
1245	34	129	Complex	9	WC-185	300	75 m (246 ft)
1522	65	200	Complex	16	WC-202	300	75 m (246 ft)

Notes: ft – feet
m – meters

It is not clear that there would be no impact on potentially significant cultural resources in the case of these 19 additional magnetic anomalies. The Applicant should address in greater detail whether any of the referenced 19 magnetic anomalies represent potential cultural resources that warrant avoidance or evaluation. In lieu of further discussion, it is recommended that these 19 magnetic anomalies be avoided during construction and be included in an approved anchor handling plan.

4.3.3 Alternate Site Location (WC-183)

WC-183 has been proposed as an alternative site for the placement of the Terminal. However, no hazard or cultural resources survey has been conducted in this lease block. Consequently, no definite statement regarding environmental or cultural resources impacts can be made at this time. If the alternate WC-183 is selected for this project, a hazard and cultural resources survey will have to be conducted prior to final selection and design of the proposed Port footprint. A cultural survey of WC-183 would require a 300-m (984-ft) lane spacing and would be required of the Applicant prior to initiating any bottom-disturbing activities in this lease block. This survey would have to be conducted according to the protocols for archaeological resource and geohazard surveys and reports. Parameters outlined in MMS NTL 2002-G01 (archaeological resources) and NTL 98-20 (geohazards) should be considered guidelines. If the survey data suggest that cultural resources might be present within the area of potential impacts, further investigation or avoidance of these areas would be required prior to installation of any offshore installation of proposed Port components.

4.3.4 No Action Alternative

Under the No Action Alternative, the Secretary would deny the license application preventing construction and operation of this deepwater Port. If the Secretary pursues the No Action Alternative, potential short- and long-term environmental effects on cultural resources identified in this EIS would not occur. Existing conditions would prevail and there would be no contribution to the Nation's natural gas supply from this source. Because of the existing and predicted demand for natural gas, it would be necessary to find other means to facilitate the importation of natural gas from foreign markets that would equal the contribution from the proposed Port. Strategies to meet this need could include other deepwater port applications, expansion of existing or construction of new onshore LNG ports, or increased use of other energy sources.

4.4 Geological Resources

4.4.1 Evaluation Criteria

Protection of unique geological features, minimization of soil erosion, and the siting of facilities in relation to mineral resources and potential geologic hazards are considered when evaluating potential impacts of a proposed action on geological resources. Generally, impacts on geological resources or caused by geologic hazards can be avoided or minimized through proper siting, foundation and structural engineering design, erosion control measures, and construction/operation techniques. The main geologic hazards that might occur on the OCS include

- Faults–sediment tectonics, halokinesis (salt dome movement).
- Slope Stability–slope steepening, slumps, creep, debris flow.
- Shallow Gas in Sediments–strength reduction, hydrates (frozen gas and water).
- Diapiric Structures–salt, mud, hydrates.
- Seafloor Depressions–blowouts, pockmarks.
- Seafloor Feature–sediment waves, differential channel fill, brine-flow channels, seafloor furrows, man-made structures.

Analysis of potential impacts associated with geological resources typically includes the following steps:

- Identify and describe the geological resources that could potentially be impacted or affect the proposed development.
- Examine the Proposed Action and the potential impacts or effects related to the resource.
- Assess the significance of potential impacts or effects.
- Provide mitigation measures to minimize the potential impacts or effects, as necessary.

Because soil resources are located onshore and no new development of onshore facilities has been proposed, an evaluation of these resources has not been performed. Should the Proposed Action require development of new onshore facilities, a soil resources evaluation would be performed.

4.4.2 Proposed Action

Implementation of the Proposed Action is expected to cause only minor and negligible long-term and short-term adverse effects associated with geological resources. The effects, although minor, would be connected with the installation of the proposed Terminal and associated take-away pipelines and Terminal/pipeline decommissioning activities. Other than siting procedures for the Terminal and take-away pipelines, no specific mitigation measures appear warranted to safeguard geological resources. There are potential hazards associated with the placement and founding of the GBS structure on the sea floor that would require additional analysis. These include foundation analysis to address the degradation of the soil under cyclic loads (e.g., pore pressure build up), stability analysis with respect to bearing and sliding capacities during a 100-year-return period event, and sedimentation studies to assess the potential rates expected during the lifetime of the Terminal (i.e., 30 years).

4.4.2.1 Terminal Placement and Operation

Considering the proposed size of the GBS structure and erosion gabions, approximately 11 acres of sea floor would be covered by the proposed Terminal, effectively removing that area from direct mineral exploration production activities. However, during the assessment of eligible locations, the Preferred Site was considered to have a low potential for economically recoverable minerals. Part of the proposed installation plans call for the placement of shallow skirts around the base of the GBS structure for erosion control and stability measures. The exact depth to which the skirts would be installed was not disclosed. While there is a network of first and second generation channels within WC-213, the proposed Terminal location would not infringe upon the channel margins. In addition to the actual placement of the GBS structures and skirts, the vessels being used during construction would likely require anchoring that would disturb seafloor sediments near the Terminal siting area. This activity, however, would not be expected to cause any adverse long-term or short-term effects.

Conversely, to be economically feasible, the proposed Terminal must have the ability to receive approximately 135 LNGC port calls per year. Although the proposed operations do not involve routine anchoring of LNGCs, an adequate anchorage near the LNG Terminal is an important safety feature. Infrequently, LNGCs have mechanical, scheduling, or other problems that could require the ship to anchor for a short period (GL 2003a). It can be expected that within the Anchorage Areas, the sea floor would encounter regular scarring from LNGC anchorage. Over the proposed 30-year service time of the Terminal, the scarring could become considerable.

4.4.2.2 Take-away Pipeline Installation and Operation

Trenching or burying of pipelines is required in water depths less than 61 m (200 ft) as an engineering precaution to reduce the movement of pipelines by high currents and storms. Trenching also reduces the risk of fishing gear becoming snagged, and of anchor or trawl damage to the pipeline. Under the current proposal, each of the take-away pipelines would be buried to a depth where their tops are 0.9 m (3 ft) below the sea floor, and 3 m (10 ft) under shipping fairways. The process used to bury natural gas pipelines in the OCS would be via a hydraulic water jetting system, which blasts surficial sediments away from the pipe as it lies on the bottom and allows it to settle to the desired depth. Jetting increases turbidity in the immediate vicinity of burial operations. It also disturbs the surficial sediments along the entire route of the pipeline (GL 2003a). The MMS grants a 61-m (200-ft) wide ROW for pipeline installation and, for the purpose of this document, the entire ROW would be considered to be impacted during the pipeline burial process. The five pipelines, stretching over a combined 106 km (65.7 mi), are expected to disturb an estimated 1,605 ac of sea floor during the installation process. Impacts on mineral exploration are not expected.

4.4.2.3 Geophysical Survey

As discussed in Section 3.4, Gulf Landing LLC contracted C&C and Fugro to complete marine geophysical surveys of the proposed Terminal area and take-away pipeline routes. Complete copies of the geophysical surveys are included with the License Application submittal. A summary of the survey's findings is presented below.

Faults–Sediment Tectonics, Halokinesis (Salt Dome Movement). Several small, benign, and inactive growth faults buried between 9 and 11 m (30 and 37 ft) below the sea floor were identified on the western side of WC-213, based on air gun data. These fault features appeared benign since there was no expression (i.e., growth) in the overburden. Three buried faults were identified within WC-167 along the proposed 30-inch pipeline route lying between 2.4 and 4.5 m (8 and 15 ft) below the sea floor.

Slope Stability–Slope Steepening, Slumps, Creep, Debris Flow. The sea floor in the eastern half of WC-213 is fairly smooth and featureless. In general, the average gradient is 0.01 percent to the south. There are several local high spots in the western half of the block that rise from 1.8 and 3 m (6 to 10 ft) above the ambient sea floor. Two of the features, in the southwestern portion of the block, are described as linear shoals. The third feature, located in the northwestern portion of the block, is described as a 10-foot high mound. Slopes on the topographic highs are steepest on their northern flanks, with gradients as high as 0.6 degrees occurring in some locations. The sea floor along the proposed take-away pipeline routes generally slope gently to the south with local occurrences of shoaling (e.g., WC-171). Average seafloor gradient ranges from a low of virtually flat to 0.62 degrees. There was no evidence of slumps, creeps, or debris flows within either the proposed take-away pipeline routes or WC-213.

Shallow Gas in Sediment–Strength Reduction, Hydrates (Frozen Gas and Water), Liquefaction. Several acoustic voids with elevated amplitudes, or "bright spots," which might represent high pressure gas zones, were mapped on the seismic data. Several areas within the proposed pipeline take-away routes also exhibited acoustic voids interpreted to be an accumulation of gas in the sediments equilibrium (i.e., WC-204). However, the gas was believed to be in a state of low pressure. The presence of shallow gassy sediment along the proposed pipeline take-away routes is not expected to pose a technical or safety problem. However, it is recommended that certain areas near the Terminal that were identified be reviewed further and possibly avoided.

Side-scan sonar records from the geophysical surveys did not show any gas vents or other indicators of gas escaping at the sea floor. In addition, there was no evidence of upwards migration of petrogenic gas from deep sources.

Diapiric Structures–Salt, Mud, Hydrates. There was no shallow geophysical evidence of diapiric structures and hydrates at the proposed Terminal area or within the proposed take-away pipeline routes (GL 2003a).

Seafloor Depressions–Blowouts, Pockmarks. The geophysical survey indicated that the sea floor at the proposed Terminal area and along the proposed take-away pipeline routes is generally smooth and featureless, with localized topographic irregularities indicative of shoaling. Within WC-213 there are several pipelines and abandoned wells, as well as numerous magnetic anomalies and sonar contacts. Although these recordings are absent from the proposed Terminal site, it is recommended that they be avoided should operations deviate away from that site. The public/company file review identified 13 structures, 19 wells, and 36 pipelines within the proposed take-away pipeline routes. In addition, 870 unidentified magnetic anomalies were recorded, as were 34 sonar contacts. The survey also identified four debris fields. Of the recordings, Sonar Contact No. 3A and Magnetic Anomalies No. 211 and No. 214 could not be reliably identified from the collected geophysical data and it was recommended that these objects be avoided by 30.5 m (100 ft) during anchor placement. A 61-m (200-ft) buffer was recommended for unidentified Magnetic Anomalies No. 18, No. 19, and No. 29 (GL 2003b).

Seafloor Feature–Sediment Waves, Differential Channel Fill, Brine-Flow Channels, Seafloor Furrows. The Geophysical Survey identified both shallow and deeper buried channels within the proposed Terminal and take-away pipeline routes. Groups of recent younger shallow channels (generally within 7.6 m [25 ft] of the sea floor) are common throughout the survey area. No megafurrows, brine-flows, or sediment waves were observed on the side-scan sonar results.

4.4.2.4 Bottom Sediment Disturbance

Minor and negligible long-term and short-term adverse effects associated with geological resources would be expected. The effects would result from direct disturbance of and construction on bottom sediments associated with placement of the proposed Terminal, installation of the proposed take-away pipelines, and decommissioning. No specific mitigation measures appear warranted.

4.4.2.5 Decommissioning

The decommissioning activities performed at the proposed Terminal site and at the take-away pipelines would be similar to the activities described under their construction; therefore, the effects would be similar.

The impacts on geological resources in the proposed Terminal and pipeline routes (and ROWs) as a consequence of decommissioning would result in the disturbance of shallow seafloor sediments. Therefore, the Proposed Action would result in local, short-term minor, and long-term negligible adverse impacts on geological resources.

4.4.2.6 Mitigation

Any significant geological hazard encountered during construction of the proposed Terminal and take-away pipelines would be avoided.

4.4.3 Alternate Site Location (WC-183)

Siting of the proposed Terminal within WC-183 would result in impacts essentially similar to those discussed for the Proposed Action. In WC-183, the proposed Terminal would be in approximately 16.5 m (54 ft) of water. The moderate difference in depth between the two locations, and their essentially equal distances from shore would not be expected to alter materially the nature or quality of the predicted impacts on geological resources.

The total length of the five proposed take-away pipeline routes for the alternate terminal location would be approximately 105.7 km (65.7 mi) shorter than the total route length for the preferred Terminal location at WC-213. It should be noted that the entire routes for the WC-183 takeaway pipelines have not been surveyed and may be required to change. The shorter distance would cause less disturbance of bottom sediments during construction. Because the pipeline installation impacts would be minor and short term for either terminal alternative the difference would not represent a significant reduction. This reduction of temporary bottom sediment disturbance would not compensate for the long term economic and safety issues associated with the alternative site.

4.4.4 No Action Alternative

Under the No Action Alternative, the Secretary would deny the license application preventing construction and operation of this deepwater Port proposal. If the Secretary pursues the No Action Alternative, potential short- and long-term environmental effects associated with geological resources identified in Section 4.4.2 of this EIS would not occur. Existing conditions would prevail and there would be no contribution to the Nation's natural gas supply from this source. Because of the existing and predicted demand for natural gas it would be necessary to find other means to facilitate the importation of natural gas from foreign markets that would equal the contribution from the proposed Port.

4.5 Socioeconomics

4.5.1 Evaluation Criteria

Criteria that define potential direct and indirect impacts on socioeconomic conditions include changes that would have some disproportionate or previously unanticipated effect on the local or regional economy (i.e., new or loss of business that affects employment), and subsequent changes to population, housing, infrastructure (schools, police, and fire services), social conditions, or employment. Also evaluated are environmental justice concerns to include disproportionate impacts on low-income or minority populations.

4.5.2 Proposed Action

Both short- and long-term minor adverse and beneficial effects would be expected from the Proposed Action. These effects would be associated with construction and operation of the proposed Port and onshore facilities, and to recreational fishing and commercial fisheries.

4.5.2.1 Commercial Fisheries

Port Installation. The combined footprint of the proposed GBS and gabion erosion structures would permanently cover approximately 11 ac of benthic substrata. The benthic substrata impacted by the proposed Terminal are typical for this region of the GOM and are not protected, or unique. It is anticipated that adverse direct or indirect impacts on the local fisheries resource from proposed Terminal construction would be offset or enhanced by the hard substrata and structure habitat created. The area occupied by the Safety Zone would be unavailable to commercial fishermen and could cause direct, negligible, or minor space-use conflicts.

The proposed pipelines construction would temporarily exclude fishing within a corridor having a maximum width of approximately 352 m (1,100 ft). Construction would remove a small area in the vicinity of the construction barge from fishing opportunities, but the direct impact would be temporary and minimal (approximately 3–4 months). The maximum excluded area represents only a very small fraction of the total fishing area in the GOM, and therefore should only result in a minimal adverse impact.

There would be temporary, indirect noise and activity disturbance in the work area during installation of the proposed Port. Most species of demersal and pelagic fish would avoid construction areas. Potential impacts on commercial fishing would be temporary and minor, resulting in fish displacement followed by rapid recolonization. Fish and crustaceans might relocate to avoid construction disturbances, but the effect is reversible. The increase in sediment loads during construction would be short-term as the suspended sediments redeposit upon completion. Temporary loss of food supply for fish and crustaceans could occur during construction; however, new structures might actually attract fish to recently disturbed areas.

Impacts on shellfish, including oyster beds, would be minimal, because the proposed facilities do not traverse any known commercial shellfish beds. Construction would remove a small area in the vicinity of the construction barge from fishing opportunities but the impact would be temporary and minimal.

Pipelines. Direct impacts from pipeline operation would be the occasional contract for special services associated with inspection and maintenance. Pipelines as a bottom feature could damage fishing gear (trawls, pots, traps). This potential impact is mitigated by the requirement that all pipelines in water depths less than 61 m (200 ft) must be installed below the mud line and their locations made public.

Potential economic losses due to snagging fishing gear on obstructions are further mitigated by the Safety Zone, which would prohibit all unauthorized traffic in the proposed Terminal vicinity. These types of losses are rare and typically less than 0.1 percent of the value of commercial fisheries landings, and are covered under the Fisherman's Contingency Fund (FERC and MMS 2001).

Port Vessels. As discussed in Section 3.2, effects on fisheries associated with Port vessel traffic would be minor.

Terminal Operations. There could be some localized direct impacts on fisheries resources associated with Terminal operations including noise avoidance, avoidance or attraction to colder oxygenated saturated discharge, and direct losses from water intakes. Required mitigation measures would minimize these impacts. Because the Safety Zone would prohibit fishing within 500 m (1,640 ft) of the proposed Terminal, it is not anticipated that these potential localized impacts would have a measurable economic impact on the regional fisheries industry.

Enforcing the Safety Zone would prohibit fishing within 500 m (1,640 ft) of the proposed Terminal. Minor direct impacts would occur depending on the time and distance of routes used by vessels throughout the area, including commercial fishing vessels. The size of the Safety Zone relative to the open offshore waters of the area would require only minor alterations to a route through the area. The water depths and bottom conditions in adjacent areas are similar to those within the Safety Zone and would not have an impact on the operations, characteristics, or activities of vessels that might currently operate within the area where a proposed Safety Zone would be located, including commercial fishing vessels. Negligible indirect beneficial impacts would occur from induced conservation associated with excluded fishing in the Safety Zone.

4.5.2.2 Recreational Fisheries

Port Installation. Direct and indirect adverse effects on recreational fisheries from project construction would be similar to impacts on commercial fisheries, and would include temporary exclusion during Port and pipelines construction. The effects would be temporary and minimal. Negligible indirect beneficial impacts would occur from induced conservation associated with the 500 m (1,640 ft) Safety Zone.

Direct and indirect adverse effects on recreational fisheries from project construction would be similar as the impacts on commercial fisheries, and would include displacement of fish due to noise disturbance in the work area, and an increase in sediment loads during installation.

Pipelines. Direct and indirect adverse effects would be similar to impacts on commercial fisheries, and would include negligible direct adverse effects for snagging fishing gear on obstructions, and disturbance to fish from transport of LNGCs to the proposed Port, and tugs and service vehicles from Cameron, Louisiana, to the proposed Port. There would be a negligible beneficial impact on fisheries from induced conservation associated with excluded fishing in the Safety Zone.

Terminal Operations. Effects on recreational fisheries would be similar to commercial fisheries as described above, including prohibiting fishing in the Safety Zone. Platforms generally attract varying pelagic species of recreational interest, including the red snapper (GMFMC 1998). Therefore, the minor adverse effect of lost fishable acreage would be offset by the minor positive effect of the metering platform. There would be a negligible beneficial impact on fisheries from induced conservation associated with excluded fishing in the Safety Zone.

As indicated by the age-1 equivalent losses of eggs and larvae that would be entrained by ORV operation (Tables 4-3 and 4-4 in Section 4.2.2.2), the operation of the ORV would not significantly impact fish populations. As noted in Section 4.2.2.2 all estimates must be viewed with consideration for the limitations associated with SEAMAP data and the assumptions used to create the life history tables. Life history table assumptions are required to compensate for the limited data available on the early life history characteristics of individual species (Appendix F, Table F-8).

It is not possible with then data available to estimate age-1 losses by taxa for eggs. As shown on Table 4-4 the age-1 equivalent losses from potentially entrained eggs could represent an annual loss between 853 and 152,851 individual age-1 fish. These losses could be comprised of up to 126 different taxa (i.e., there are 126 different taxa represented in the larval data), indicating that the loss to any one specific taxa would be insignificant.

Indirect impacts can be judged by the minimal age-1 equivalent losses of bay anchovy and menhaden. Bay anchovy and menhaden are highly abundant and important forage fish. Estimated annual age-1 losses of forage fish might range from approximately 5,000 to approximately 45,000 individual age-1 fish.

Red drum and red snapper are important commercial and recreational fish. Annual age-1 equivalent losses estimated for potentially entrained red drum larvae range from 8,000 to 23,000 age-1 fish. Estimated annual age-1 losses using the red snapper larvae life table would range from approximately 59 to 661 age-1 fish. Based on the age-1 equivalent losses estimated for these species, it is unlikely that eggs and larvae potentially entrained by the ORV would have affect fishing or have an adverse economic impact on these recreational and commercial fisheries. The number of age-1 equivalent losses of menhaden as a result of potentially entrained larvae is approximately 14,000 age-1 fish, which is a relatively small number compared to the range of recruits to age-1 menhaden in the 1990s (13 to 23 billion) (GSMFC 2002). Similar trends are expected for other species of eggs and larvae that are potentially entrained by the ORV seawater intake associated with the proposed action.

4.5.2.3 Oil and Gas Leasing, Exploration, and Production Activities

Port Installation. If approved, the deepwater Port license would grant the Applicant surface rights for the proposed Terminal site, Anchorage Area, and Safety Zone. A formal lease at WC-213 would not be required. This leaves the mineral rights associated with the lease block open for future exploration and production by other parties. By restricting all vessel traffic not related to the proposed deepwater Port operations, the Safety Zone allowed for deepwater ports would effectively restrict the installation of above-water structures supporting exploration within 500 m (1,640 ft) around the proposed Port until decommissioning. The proposed Safety Zone would be entirely within WC-213.

No direct effects on oil and gas leasing, exploration and production activities would occur from the proposed Port.

Pipeline Installation. Direct impacts from pipeline construction could be potentially significant on the existing infrastructure from trenching, anchor placement, and laying of the pipeline. Gulf Landing LLC would take precautions as appropriate to minimize impacts on the pipelines crossed in Federal OCS waters, including using an approved anchoring plan. Gulf Landing LLC would use best industry practices to avoid damage to other pipelines at these crossings. The Applicant's proposed pipeline routes would cross 23 existing pipelines, 8 of which are abandoned. The pipelines would not exclude resource exploration or extraction from the lease blocks crossed. There would be a negligible indirect adverse effect from the presence of pipelines, which would preclude the installation of structures supporting exploration until pipeline.

Terminal Operations. No direct effects on oil and gas leasing, exploration, and production activities would occur from Terminal operations. There are no current proposals for oil or gas exploration within WC-213. WC-213 is considered to have low potential for significant resource finds. Locating the proposed Terminal in WC-213 would exclude development and operations within the 500 m (1,640 ft) Safety Zone. The proposed Port would have an impact on potential siting and operation plans within the block but would not preclude the exploration or extraction of mineral resources from the block.

4.5.2.4 Marine Shipping

Port Installation. The proposed Port would be constructed outside shipping fairways and navigation channels, and would have no direct effect on shipping or navigation activities. There would be minimal adverse indirect effects on shipping lanes or channels from increased traffic and potential collisions with support vessels during construction. Site-specific studies and review of existing maps would identify buried pipelines or other subsea infrastructure and mitigate potential impacts within the preferred LNGC transit corridor and Anchorage Area.

No adverse direct or indirect effects on marine shipping would occur from Port fabrication activities.

Pipeline Installation. There would be negligible adverse indirect effects on shipping lanes or channels from increased traffic and potential vessel collisions with pipeline barge and support vessels associated with pipeline operation.

Terminal Operations. The proposed Port and anchorages would be located outside shipping fairways and navigation channels, and would not impact shipping or navigation activities. There would be minimal impacts on any shipping lanes or channels, such as increased traffic and potential collisions with support vessels during port operations. Potential safety concerns associated with LNGC traffic and potential vessel collisions with other shipping is discussed in Section 4.10.7, Marine Safety. As previously discussed, the Applicant assumed that LNGCs would approach the proposed Terminal from the Calcasieu Pass Fairway. There are navigation aids presently installed along established fairways that would be used by the LNGCs. A racon (radar signaling) device would be installed on the proposed Terminal. As discussed in Section 4.10.7.6, the 500-m (1,640 ft) Safety Zone would exclude all unauthorized traffic. The proposed Terminal area is not a recognized thoroughfare for local shipping, and the Safety Zone would have little to no impact on commercial or recreational vessel traffic.

4.5.2.5 Onshore Activities

Port Installation. Direct and indirect, short-term beneficial effects would occur on onshore activities related to the installation of the proposed Port due to increased employment and the purchase of goods and services. At the time of the application, the Applicant estimated that offshore installation of the GBS caissons would take about 4 months and employ 60 to 100 workers. Based on the history of offshore oil and gas industry information, it is estimated that about 30 percent of the total workers would be residents of Cameron Parish and 70 percent would be nonlocal residents. Direct, short-term, minor beneficial effects would occur from the 18 to 30 local workers and 42 to 70 nonlocal workers that would be employed to support project construction. Indirect, short-term, minor beneficial effects would occur from secondary spending by those employed workers and for goods and services to support project construction. The Applicant has not estimated the value of project construction and installation, so the direct and indirect economic benefits could not be quantified.

The western and central GOM, off the shore of Texas and Louisiana, are two of the most active offshore oil and gas areas in the world (MMS 2001; USCG and MARAD 2003a). A majority of the equipment and facilities supporting GOM oil and gas operations are inshore of the western and central GOM. Short-term, indirect beneficial effects on infrastructure might occur from investment infrastructure. The Applicant has not estimated the value of project construction, so the direct and indirect economic benefits could not be quantified.

There would also be short-term, minor-to-major adverse and beneficial impacts from the demand for housing from construction projects and seasonal recreation (not considering any large project under construction in the same area). This would reduce availability of housing especially during peak season for tourism. In areas of seasonal tourism, fabrication workers might displace tourists, which could be a concern for motel and campground operators who depend on repeat business and might be reluctant to provide housing for construction workers, since seasonal trade would potentially be turned away and lost. There might be a potential for shortage in housing. Number of people in one household would drive demand for different housing unit categories. The demand would increase depending on the family size.

There would also be short-term, minor-to-major adverse and beneficial effects on public services from local and nonlocal workers. Increased employment would have a temporary, beneficial impact on the local tax base. However, nonlocal workers might also bring family members that would increase demand on existing public services, which might result in an overall adverse effect on public services if demand was greater than the increase in taxes.

Pipeline Installation. The Applicant would contract with an existing company for fabrication of new pipeline would utilize an existing site for the onshore staging area. It is assumed that the lay barge, trenching barge, and support vessels would be provided by the contracted pipeline company, and would employ approximately 200 workers. Because of the prevalence of pipeline construction vendors in the region, it is anticipated that these workers would be local to Louisiana or east Texas. Pipeline construction workers might be housed on the pipe-laying barges during construction activities and remain offshore, except for crew changes when workers would return to their homes. The proposed pipeline construction is estimated to occur over a period of about 5 months. Pipeline operations would be conducted as needed from an undetermined onshore staging area. Therefore, the primary direct impacts would be from procuring goods and services to support the crews.

Terminal Operations. Direct and indirect, short-term major beneficial effects would occur from operation of the Port throughout its projected lifespan of 30 years due to increased employment and the purchase of goods and services. At the time of the application, the Applicant estimated that the Port would employ approximately 100 workers, which would represent about 2.3 percent of the civilian labor force in Cameron Parish and 14 percent in Cameron. This does not include the four tugboat crews or crews from contracted service vessels.

There would also be short-term, minor adverse and beneficial indirect impacts from the demand for housing for port workers. If all 100 workers move into the area and require new housing, 100 new residences would represent 2.8 percent of existing residences in Cameron Parish and 14.4 percent in Cameron. In 2000, there were 42 permits issued for new housing, so the demand for 100 new residences would create a significant impact on the local housing industry. Demand for housing might have a short-term adverse effect on housing availability, especially during peak season for tourism. There would also be short-term, negligible-to-minor adverse and beneficial effects on public services from new workers and residences. Increased employment would have a beneficial impact on the local tax base. However, workers might also bring family members that would increase demand on existing public services, which might result in an overall adverse effect on public services if demand was greater than the increase in taxes.

4.5.2.6 Environmental Justice

As discussed in Section 3.5.2.6, Cameron and Cameron Parish have a similar proportion of minorities as in Louisiana. The unemployment rate in Cameron Parish is also lower than both the statewide and nationwide averages, and the portion of residents living below the poverty level is similar to the statewide average. However, the percent of residents who have obtained a high school diploma is much lower in Cameron and Cameron Parish compared to statewide or nationwide averages. Since a substantially larger portion of residents in Cameron (31.5 percent) and Cameron Parish (16.6 percent) work in agriculture, forestry, fishing and hunting, or mining industries compared to the statewide average (4.2 percent), residents of Cameron and Cameron Parish would be more sensitive to any impacts the Proposed Action might have on the commercial or recreational fishing industries. Since they have less education, they would also have fewer options for other jobs and could quickly decline into poverty status. Conversely, since a larger portion of residents in Cameron Parish work in construction than in Cameron or the statewide or nationwide averages, residents of Cameron Parish might be in a position to benefit from project construction activities.

The Applicant is not expected to propose a fabrication site until the fourth quarter of 2004. At this time project fabrication is not ready for evaluation. If a fabrication yard were proposed for the Port, the appropriate supplemental NEPA documentation would be developed to evaluate the proposal's consistency with EO 12898.

The remaining Proposed Action components would occur predominately in GOM waters. Impacts on residential areas, regardless of ethnic and minority composition, would be avoided. Even with the temporary increase of construction workers, the Proposed Action would not cause adverse environmental or disproportionate human health effects on minority or low-income communities.

4.5.2.7 Mitigation

Project impacts related to population, employment, housing, public services, vessel traffic, and shipping would be minimal and easily adsorbed within the existing GOM regional resources and socioeconomic infrastructure. The onshore fabrication and support-base operations would be at available existing facilities and would require no new land or displacement of existing land use. These resources would require no further mitigation as a result of the Proposed Action.

Commercial Fisheries – Safety Zone. Designation of the proposed Terminal Safety Zone would result in an extremely localized, but long-term loss of use of commercial fisheries within 500 m (1,640 ft) of the Terminal. Biotic and abiotic conditions within the Safety Zone are typical of conditions within the surrounding Gulf region. Fishing efforts could be displaced to nearby areas without the need for further mitigation.

Commercial and Recreational Fisheries – Construction. The Proposed Action would cause permanent loss of approximately 11 ac of benthic substrate associated with the proposed Terminal and temporary impacts on approximately 1,576 ac of the benthic substrata within the proposed pipelines. Installation of the proposed pipelines would temporarily preclude use of the pipeline route during construction activities. Additional impacts would be associated with avoidance of noise and activity.

Temporary short-term benthic disturbances and displacement due to installation noise and activity would be minimized by applying regulated operating procedures and industry standards. Mobile fauna would readily relocate to adjacent areas and would move back into the disturbed area without further mitigation. Benthic organisms would begin to colonize the disturbed substrate soon after completion of construction activities, without the need for further mitigation.

Commercial and Recreational Fisheries – Terminal Operations. Potential impacts on fisheries resources might be associated with impingement/entrainment losses, noise, temperature, and turbidity. It is assumed that proposed Terminal operations would have only localized impacts on fisheries resources, and that the there would be no measurable effects on commercial fisheries outside the Safety Zone.

Commercial Fisheries – Decommissioning. All potential effects on fisheries resources associated with Port operations would terminate and return to ambient conditions. Complete removal of all aboveground Port infrastructure would result in the loss of hard substrata habitat that might have developed over the life of Port operations. Any benefits to fisheries resulting from the fishing exclusions within the Safety Zone would be removed. The removal of the Safety Zone would reopen that area to commercial fishing. The Safety Zone would continue to be enforced during decommissioning activities.

To minimize potential fisheries impacts associated with the decommissioning of the proposed Terminal facilities, it would be possible to leave some of the facility's underwater structure in place to function as an artificial reef. All decommissioning activities would be conducted in accordance with approved plans required by the licensing authority, and in compliance with all applicable and appropriate regulations and guidelines in place at the time of decommissioning.

Oil and Gas Leasing, Exploration and Production Activities. Gulf Landing LLC would take precautions as appropriate to minimize impacts on the pipeline crossed during construction of the take-away pipelines, including using an approved anchoring plan.

4.5.3 Alternate Site Location (WC-183)

Siting of the proposed Port in WC-183, approximately 1.6 km (8 mi) north of the proposed Port Terminal location in WC-213, would result in impacts essentially similar to those discussed for the Proposed Action. Aspects of Port installation and potential effects on commercial fisheries would be essentially the same in both locations. The greater number of active platforms in the vicinity of WC-183 could be an indication that there could be a greater interference with existing and future OCS activities. At this time these potential impacts do not preclude the use of WC-183 for locating a deepwater port.

4.5.4 No Action Alternative

Under the No Action Alternative, the Secretary would deny the license application preventing construction and operation of this deepwater Port proposal. If the Secretary pursues the No Action Alternative, potential short- and long-term environmental effects on socioeconomic resources identified in Section 4.5.2, would not occur. Existing conditions would prevail and there would be no contribution to the Nation's natural gas supply from this source. Because of the existing and predicted demand for natural gas it would be necessary to find other means to facilitate the importation of natural gas from foreign markets that would equal the contribution from the proposed Port. Strategies to meet this need could include other deepwater port applications, expansion of existing or construction of new onshore LNG ports, or increased use of other energy sources.

4.6 Recreation

4.6.1 Evaluation Criteria

Impacts on recreational resources would occur when a proposed action causes interference with coastal access or waterways for recreational use or causes degradation of a significant recreational resource. Impacts on recreation associated with construction and operation of the proposed Port would be indicated by impairment to recreational fishing activities and other water-dependent uses associated with the Proposed Action.

4.6.2 Proposed Action

Short-term minor adverse impacts on recreational fishing, boating, and other water-dependent uses would result from construction activities.

Minor adverse effects on recreational boating and fishing would be associated with installation of the proposed Terminal. Towing of the GBSs from the fabrication site to WC-213 could require recreational vessel traffic to detour from their course to avoid the construction activities. This would be a temporary circumstance, the duration of which cannot be estimated because the location of the platform fabrication yard and distance to WC-213 are not known.

Minor adverse effects on recreational fishing would be associated with construction of the pipelines. Construction of the pipeline could cause minor, temporary displacement of recreational fishing for the estimated 60 to 75 days required to lay the pipeline. Displacement would occur only in the area where barges and support vessels would operate. Jetting of sediment along the pipeline path would disturb fish by causing suspension of sediment. Sea bottom habitat would return to its prior condition upon the resettling of the habitat and renewed growth of any vegetation impaired by the pipeline burial activities. Once installed, and following hydrostatic testing, operation of the pipeline would have no effects on recreation.

Operations at the onshore base would occur at existing facilities and would not affect recreation opportunities.

Neither the proposed pipelines nor the Terminal would be in designated recreation and public interest areas such as marine reserves, wildlife refuges or sanctuaries, or state parks. The Proposed Action would not be expected to interfere with recreational enjoyment of these resources.

4.6.3 Mitigation

Conditions in the GOM adjacent to and in the area of the proposed activities are generally similar to those within the proposed construction and operation areas. Vessel traffic and other water dependent recreational uses that might otherwise use the restricted areas can easily relocate to adjacent or nearby areas with little additional effort. No mitigation measure would be required as a result of the Proposed Action.

4.6.4 Alternate Site Location (WC-183)

Long-term minor beneficial and minor adverse impacts on recreation would be expected. Siting of the Port in WC-183, approximately 1.6 km (8 mi) north of the location proposed by Gulf Landing LLC in WC-213, would result in essentially similar impacts. There are no differences between the WC-213 location and WC-183 location that would result in a measurable impact to recreational resources.

4.6.5 No Action Alternative

Under the No Action Alternative, the Secretary would deny the license application preventing construction and operation of this deepwater Port proposal. If the Secretary pursues the No Action Alternative, potential short- and long-term environmental effects on recreational resources identified in Section 4.6.2 of this EIS would not occur. Existing conditions would prevail and there would be no contribution to the Nation's natural gas supply from this source. Because of the existing and predicted demand for natural gas it would be necessary to find other means to facilitate the importation of natural gas from foreign markets that would equal the contribution from the proposed Port. Strategies to meet this need could include other deepwater port applications, expansion of existing or construction of new onshore LNG ports, or increased use of other energy sources.

4.7 Transportation

4.7.1 Evaluation Criteria

Significant impacts on transportation would occur when a proposed action would cause long-term interference with access to transportation routes, or crowding of routes resulting in substantially increased risks of collisions or other mishaps (e.g., grounding). Impacts on transportation would also be considered when they would affect large populations or represent a substantial degree of change over current conditions. Transportation also includes the existing infrastructure of roads, rails, and waterways.

4.7.2 Proposed Action

Long-term minor adverse impacts on transportation would be expected. These effects would occur in connection with increased LNGC use of established fairways and slightly increased tugboat, supply vessel and helicopter traffic transiting the GOM between onshore bases in Louisiana and the proposed Terminal location.

Marine Traffic. The Applicant anticipates unloading approximately 135 LNGCs per year with the LNG supply sourced from several locations. This number of ships utilizing the established regional Safety Fairways would not have a significant effect on vessel traffic. Port operations and vessel traffic associated with and in the vicinity of the proposed Port would be managed by the terminal, as guided by the Port Operations Manual. This would include additional trips associated with the proposed Port support tugs. The four proposed tugs would each make 135 trips to and from the Port each year for a total of 1,080 additional transits per year.

If the license were approved, a 500-m (1,640-ft) Safety Zone would be established around the proposed Terminal facility. This Safety Zone would exclude all unauthorized vessels and activities and could be enforced by the USCG. The LNGC speed limit within the Safety Zone would be 3 knots. A Precautionary Area would also be proposed around the Terminal facility to extend from the outer limit of the Safety Zone to 3.2 km (2 mi) from the proposed Terminal. This area would demarcate an area on nautical charts where mariners would be advised to be alert to the presence of LNGCs and Terminal support vessels operating in the area. The LNGC speed limit within the Precautionary Area would be 5 knots. No regulatory restrictions would be associated with this area. Navigation demarcations associated with the proposed Port would be developed and implemented in accordance with the appropriate domestic and international regulations and guidelines. If implemented, these areas would minimize the potential for collisions and other impacts related to LNGC and support vessel traffic moving through the area.

Modern technology and vessel operating procedures combine to make commercial shipping safe. The chance of a collision between an LNGC and another vessel or an existing platform is very unlikely. All practical and appropriate engineering and procedural means to minimize the chances of a collision or navigation accident associated with LNGCs and support vessels while operating in the OCS would be developed, approved, and implemented in consideration of all applicable regulations and guidelines.

Use of the High Seas. Issuance of a license under the Deepwater Port Act requires that " ... a deepwater port will not unreasonably interfere with international navigation or other reasonable uses of the high seas, as defined by treaty, convention or customary international law." (33 U.S.C. § 1503(c)(4)) Moreover, Congress declared as policy "...that nothing in the Act shall be construed to affect the legal status of the high seas, the superadjacent airspace, or the sea floor and subsoil, including the Continental Shelf." (33 U.S.C. 1501(b))

The Deepwater Port Act provides that U.S. jurisdiction shall apply to U.S. vessels and persons on board. Such jurisdiction shall also apply to vessels registered in or flying the flags of foreign states and persons on board such vessels whenever they are calling at or otherwise utilizing a deepwater port and are within its safety zone. (33 U.S.C. 1518(c))

The United Nations Convention on the Law of the Sea (UNCLOS) came into effect subsequent to enactment of the Deepwater Port Act.[18] Designation of the U.S. EEZ also occurred subsequent to enactment of the Deepwater Port Act. Article 60 of UNCLOS grants a coastal state the exclusive right to construct, authorize, and regulate installations and structures, including deepwater ports, in its EEZ. Also, the freedom of all nations to make reasonable use of waters beyond their territorial boundaries is recognized by the 1958 International Convention on the High Seas, which defines the term "high seas" to mean all parts of the sea that are not included in the territorial sea or in the internal waters of a state. The United States is not a party to UNCLOS, but as a matter of policy abides with most of its provisions.[19]

Prior to the United States' agreement to abide by the concept of the EEZ as contained in UNCLOS, under the Deepwater Port Act, a distinction had been made between foreign flag vessels using a deepwater port and those only navigating in the vicinity of the ports. At that prior time, for vessels calling at deepwater ports, the United States exercised the right and authority as the licensing state to condition the use of the port on compliance with reasonable regulations, including acceptance of general jurisdiction of the United States. If such conditions were not accepted by a foreign state, use of the deepwater port must be denied to vessels registered in or flying the flag of that state. (33 U.S.C. 1518(c)).

The Deepwater Port Act requires the State Department to notify the government of each foreign state having vessels under its authority or flying its flag that might call at a deepwater port and that the United States intends to exercise jurisdiction over. (33 U.S.C. 1518(a)(3)). The notification shall indicate that, absent the foreign state's objection, its vessels will be subject to jurisdiction whenever they call at the deepwater port or are within the 500-m (1,640-ft) Safety Zone, and use or interfere with the use of the deepwater port. Further, the Act states that entry by a vessel into the deepwater port is prohibited unless a bilateral agreement between the flag state of the vessel and the United States is in force, or if the flag state does not object to the exercise of U.S. jurisdiction. (33 U.S.C. 1518(c)(2)).

Thus, any ship calling at a deepwater port in the U.S. EEZ would be subject to U.S. jurisdiction as if it were in the territorial sea. As the proposed Gulf Landing deepwater Port would be in the EEZ, this principle would apply. Any ship flying the flag of a party to UNCLOS would be bound to the same jurisdictional principles as in the Deepwater Port Act, thus obviating the need for further bilateral agreements. However, if a ship flying the flag of a non-party to UNCLOS were to call at the deepwater

[18] The UNCLOS may be viewed at *http://www.univie.ac.at/RI/KONTERM/intlaw/konterm/vrkon_en/html/doku/unclos.htm#70.0.*

[19] United States Oceans Policy, Statement by the President (March 10, 1983), Weekly Compilation of Presidential Documents (Vol. 19, No. 10), Administration of Ronald Reagan ("Today I am announcing three decisions to promote and protect the oceans interests of the United States in a manner consistent with those fair and balanced results in the Convention and international law. First, the United States is prepared to accept and act in accordance with the balance of interests relating to traditional uses of the oceans-such as navigation and overflight. In this respect, the United States will recognize the rights of other states in the waters off their coasts, as reflected in the Convention, so long as the rights and freedoms of the United States and others under international law are recognized by such coastal states. Second, the United States will exercise and assert its navigation and overflight rights and freedoms on a worldwide basis in a manner that is consistent with the balance of interests reflected in the convention. The United States will not, however, acquiesce in unilateral acts of other states designed to restrict the rights and freedoms of the international community in navigation and overflight and other related high seas uses.")

Port, the State Department would only object to such calls if the non-party flag state had filed an objection with the United States.

As permitted by 33 U.S.C. 1509(d), Gulf Landing LLC has requested establishment of a safety zone. The USCG may determine it is reasonable to establish a 500-m (1,640-ft) safety zone. International law also plays a role in this area.[20] The Convention on the Continental Shelf of 1958 also provides for the construction and operation of continental shelf installations and the coastal states' establishment of safety zones, which may extend to a distance of 500 m (1,640-ft) around such installation.[21] For those vessels navigating in the vicinity of a deepwater port, the United States is entitled to take measures necessary to avoid collision and environmental hazard within the Safety Zone. Outside the 500-m (1,640-ft) Safety Zone, uniform international rules to ensure navigational safety around the deepwater Port can best be achieved by seeking appropriate ships' routing measures through the IMO. Because the USCG is also reviewing an area to be avoided that is beyond the 500-m (1,640-ft) domestic Safety Zone (the "Precautionary Area"), the IMO would be approached and consulted. In addition to these safety measures, the Captain of the Port has authority to introduce additional vessel movement controls to enhance the safety of ship movements to and from the proposed Port. Moreover, the Port Operations Manual, which Gulf Landing, LLC, is required by regulations to develop for USCG approval, would specify vessel operating and security procedures for LNGCs calling at the deepwater Port.[22]

In light of the foregoing, Gulf Landing LLC would be permitted under the principles of international law and it would not unreasonably interfere with international navigation or other reasonable uses of the high seas, as defined by treaty, convention, or customary international law.

Ports. The LNGCs would not be expected to make port calls along the Gulf Coast, and, therefore, would not add to nearshore shipping traffic unless required for repairs or other unusual circumstances.

Operation of the proposed Port would necessitate use of service vessels, most likely on a weekly basis, to provide supplies and personnel transport. These service vessels would be berthed at existing facilities. In light of the more than 9 million annual service vessel trips supporting existing platforms in waters up to 60 m (197 ft) in depth (MMS 2002a), the number of support vessel trips to and from the proposed Terminal would be negligible and would not significantly increase existing vessel traffic in the Louisiana coastal region or in offshore areas.

Aviation. As noted in Section 3, the FAA regulates helicopter flight patterns and altitudes. Helicopter flights to support the Gulf Landing Port would have to abide by these regulations. The possible addition

[20] Navigation safety zones are governed by three principal sources: UNCLOS (Articles 22, 60, and 211); the International Convention on the Safety of Life at Sea, 1974, Annex, Chapter V (primarily Regulation V/10); and the General Provisions on Ship's Routing, adopted by the IMO pursuant to Assembly Resolution A.572 (14), as amended.

[21] Convention on the Continental Shelf, 15 U.S.T. 471 (1958), Article 5 provides in part: "2. ... the coastal State is entitled to construct and maintain or operate on the continental shelf installations and other devices necessary for its exploration and the exploitation of its natural resources, and to establish safety zones around such installations and devices and to take in those zones measures necessary for their protection." "3. The safety zones ... may extend to a distance of 500 meters around the installations and other devices which have been erected, measured from each point of their outer edge. Ships of all nationalities must respect these safety zones." 4. Such installations and devices, though under the jurisdiction of the coastal State, do not possess the status of islands. They have no territorial sea of their own, and their presence does not affect the delimitation of the territorial sea of the coastal State."

[22] The USCG has the additional statutory responsibility to approve an operations manual for a deepwater port. 33 U.S.C. $1503(e)(l). The USCG retained its statutory and delegated authorities upon its transfer to the Department of Homeland Security (Department of Homeland Security Delegation Number: 0170, Sec. 2. (75), March 3, 2003; Pub. L. 107-296, section 888.).

of a small number of flights would result in only a minor increase in total helicopter traffic. The expected increase in helicopter traffic, estimated at 52 round-trip flights per year, would be negligible given the current levels being experienced in the GOM (MMS 2001).

Highways. The Applicant intends to contract with an existing logistics/supply base for performance of supply and support operations. While quarters aboard proposed Port would have a capacity of 60 personnel in two-person cabins, the normal operating crew is anticipated to be 30 personnel. These personnel would be transported to the proposed Port from the contracted logistics/supply base or from a heliport. Their commuting to and from these points of departure would have no measurable impact on the local traffic.

Rail. Onshore activities in connection with operation of the proposed Port would be limited and would not have a measurable impact on local or regional rail transportation.

Mitigation. No mitigation measure would be required as a result of the Proposed Action.

4.7.3 Alternate Site Location (WC-183)

Siting of proposed Port in WC-183, approximately 13 km (8 mi) north of WC-213, would result in impacts similar to those expected to occur in the Preferred Alternative location. Siting at WC-183 would require slightly different approach and departure routes to and from the Terminal for LNGCs using the Calcasieu Fairway. Given the short distance involved, however, the differences would be negligible. Impacts on other aspects of transportation are expected to be similar to those of the Proposed Action. The presence of a greater number of active OCS platforms in the vicinity of WC-183 (Figure 2-2) could have a greater adverse impact on vessel operations at the site.

4.7.4 No Action Alternative

Under the No Action Alternative, the Secretary would deny the license application preventing construction and operation of this deepwater Port proposal. If the Secretary pursues the No Action Alternative, potential short- and long-term effects on traffic resources identified in Section 4.7.2 of this EIS would not occur. Existing conditions would prevail and there would be no contribution to the Nation's natural gas supply from this source. Because of the existing and predicted demand for natural gas it would be necessary to find other means to facilitate the importation of natural gas from foreign markets that would equal the contribution from the proposed Port. Strategies to meet this need could include other deepwater port applications, expansion of existing or construction of new onshore LNG ports, or increased use of other energy sources.

4.8 Air Quality

4.8.1 Evaluation Criteria

The potential impacts on local and regional air quality conditions near a Proposed Action are determined by the increases in regulated pollutant emissions relative to existing conditions and ambient air quality. As discussed in Section 3.8, USEPA will be the regulatory authority for air emissions associated with deepwater ports.

For the purposes of this evaluation, USCG and MARAD will defer to USEPA to determine significance through the permit process. As a result, significance and approval of the License will be conditional on the proposed Port's ability to obtain and comply with Title V and any other applicable air permits.

The evaluation of the permit application will include, among other factors, the effect on NAAQS "attainment" or unclassifiable areas would be considered significant if the net increases in pollutant emissions from the Proposed Action resulted in one of the following three scenarios:

- Cause or contribute to a violation of any NAAQS
- Expose sensitive receptors to substantially increased pollutant concentrations
- Violate applicable permit requirements

NAAQS standards are presented in Table 4-10. The Proposed Action is in an area presumed to be in attainment with applicable ambient standards. The MMS normally reviews proposed new or modified pollutant sources in OCS waters to evaluate potential impacts of the proposed source on onshore air quality, especially noting whether the source would contribute to any violation of the NAAQS.

USEPA Region 6 would be the regulatory authority, and the impacts resulting from direct and indirect emissions from stationary emissions sources under this Proposed Action will be addressed through USEPA's Federal permitting requirements under Title V regulations (40 CFR Part 71).

USEPA's national air program is currently developing a nationally consistent policy regarding the regulation of deepwater port air emissions. In light of the absence of such standards, MMS analysis requirements as applied to other emissions sources in the GOM are the most appropriate frame of reference for quantifying the significance of potential environmental impacts.

The MMS requires new OCS facilities to predict impacts using an approved model to determine whether the projected emissions of air pollutants from the facility result in an onshore exceedance of existing air quality standards (i.e., above the modeling significance levels) for criteria pollutants. The proposed port is not classified as an OCS facility under the MMS. Table 4-11 outlines the air resource impact levels applicable to other offshore operations in the GOM.MMS modeling significance impact levels are set at the same concentrations as the current USEPA significance levels for new or modified major PSD sources affecting nonattainment areas (40 CFR Part 51).

The projected emissions of any air pollutant (other than VOC, from the proposed facility) that would significantly affect the quality of a nonattainment area would have to be fully reduced. This reduction would be accomplished through the application of Best Available Control Technologies (BACT) and, if additional reductions are necessary, through the application of additional emissions controls or through the acquisition of offshore or onshore offsets. Similarly, the projected emissions of any air pollutant (other than VOC) that would significantly affect the quality of attainment or unclassifiable areas would be required to be reduced through the application of BACT.

Table 4-10. NAAQS, Prevention of Significant Deterioration (PSD) Increments, PSD Significant Emissions Rates, and Modeling Significance Levels

Pollutant	National Ambient Air Quality Standards (NAAQS)[1]						PSD Increments ($\mu g/m^3$)		PSD Significant Emissions Rates[2] (tons/year)	Modeling Significance Levels ($\mu g/m^3$)	Federal Land Manager Modeling Significance Levels ($\mu g/m^3$)
	Averaging Period	Primary ($\mu g/m^3$)	Primary (ppm)	Secondary ($\mu g/m^3$)	Secondary (ppm)	Form (i.e., how standard is applied)	Class I	Class II			
PM_{10}	Annual	50	--	50	--	Annual arithmetic mean, averaged over 3 years	4	17	15	1	0.16
	24-hour	150	--	150	--	99th percentile of concentrations in a given year, averaged over 3 years	8	30	--	5	0.32
$PM_{2.5}$	Annual	15	--	15	--	Annual arithmetic mean, from single or multiple monitors, averaged over 3 years	PSD Increments and Significant Emissions Rates have not been established for $PM_{2.5}$.				
	24-hour	65	--	65	--	98th percentile of concentrations in a given year, averaged over 3 years	--	--	--	--	--
SO_2	Annual	(80)	0.03	--	--	Annual arithmetic mean	2	20	40	1	0.1
	24-hour	(365)	0.14	--	--	Not to be exceeded more than once per calendar year	5	91	--	5	0.2
	3-hour	--	--	(1,300)	--	Not to be exceeded more than once per calendar year	25	512	--	25	1
NO_2	Annual	(100)	0.053	(100)	0.053	Annual arithmetic mean	2.5	25	40 of NO_x	1	0.1
O^3	8-hour	(157)	0.08	(157)	0.08	3-year average of annual fourth highest daily maximum 8-hour concentrations	--	--	--	--	--
	1-hour	(235)	0.12	(235)	0.12	Not to be exceeded more than 3 times in 3 consecutive years	--	--	40 of NO_x	--	--
CO	8-hour	(10,000)	9	--	--	Not to be exceeded more than once per calendar year	--	--	100	500	--
	1-hour	(40,000)	35	--	--	Not to be exceeded more than once per calendar year	--	--	--	2,000	--
Lead	Calendar Quarter	1.5	--	1.5	--	Maximum arithmetic mean	--	--	0.6	--	--

[1] NAAQS are expressed in $\mu g/m^3$ for particulate matter and lead and in parts per million (ppm) for other pollutants. For reference, corresponding equivalent standards are shown in parentheses.

[2] Lower significant emissions rates apply in certain nonattainment areas for nonattainment new source review. Sources within 10 km of Class I areas can trigger PSD if impacts exceed 1 $\mu g/m^3$ (24-hour average).

Table 4-11. Significant Impact Levels for Air Emissions

Pollutant	Averaging Period	MMS Significant Impact Levels[1] ($\mu g/m^3$)	FWS Significant Impact Levels[2] ($\mu g/m^3$)
NO_2	Annual	1.0	0.1
SO_2	Annual	1.0	0.1
	24-hour	5.0	0.2
	3-hour	25	1.0
PM_{10}	Annual	1.0	0.16
	24-hour	5.0	0.32
CO	8-hour	500	N/A
	1-hour	2,000	N/A

Notes:[1] 30 CFR Chapter II, MMS, Department of the Interior, Section 250.303(e); 30 CFR Chapter II, MMS, Department of the Interior, Section 250.45(e).

[2] Update and clarification of Guidance Document for the Review of Offshore Air Pollutant Emissions Sources, USFWS, September 1997.

NO_2 – nitrogen dioxide

SO_2 – sulfur dioxide

PM_{10} – particulate matter equal to or less than 10 microns in diameter

CO – carbon monoxide

$\mu g/m^3$ – micrograms per cubic meter

4.8.2 Proposed Action

Long-term minor adverse impacts on air quality would be expected. These impacts would be associated primarily with operation of equipment on the proposed Terminal.

4.8.2.1 Construction Impacts

Since construction would not occur at a single location for any significant length of time, the impact of these emissions at any single location would be minor and short-term. Emissions from construction equipment would have an insignificant impact on the air quality of the region.

Regulated criteria pollutants and HAPs would be emitted during the transportation of the two GBS caissons to the project site, the installation of the caissons and associated rigging and equipment, and the construction and testing of the pipeline extension to the project site. Construction would cause temporary reduction of local ambient air quality due to emissions generated by the tug boats, barge-mounted cranes, and other auxiliary mobile equipment working offshore. The emissions during construction activities, which would occur during 2008, would come from fuel combustion in the barge and support boat engines, and would consist of NO_x and CO; and small amounts of VOC, PM_{10}, and SO_2 emissions. Table 4-12 summarizes the regulated pollutant emissions estimates from the proposed construction activities and equipment from this Proposed Action—all of which would occur in 2008.

Table 4-12. Offshore Construction Emissions in 2008

Source Category	Emitted Pollutant (tpy)				
	PM	SO_x	NO_x	VOC	CO
Transport of GBS caissons to project site	7.19	33.00	247.28	7.42	53.95
Setting of the caissons and installation of equipment on the Terminal	14.85	57.64	429.81	15.67	93.68
Installation of five natural gas pipelines	25.16	115.19	868.48	26.05	189.49
Totals:	**47.2**	**205.8**	**1545.6**	**49.1**	**337.12**

Source: GL 2003b

Notes: Distance from proposed Terminal to the closest onshore area of the state is 38 statute miles. A small part of these emissions (emissions from tugs as the caissons are towed from the graving dock facility onshore) would take place at a distance less than 61 km (38 mi) from the shore. Emissions include tugs and a derrick barge used to install pipeline; tugs used to transport the caissons to the proposed site; and tugs, derrick barge, and supply vessels used to install the platform and associated equipment.

tpy – tons per year
PM – Particulate matter
SOx – Sulfur Oxide
NOx – Nitrogen Oxide
VOC – Volatile Organic Compounds
CO – Carbon Monoxide

4.8.2.2 Terminal Operations

The stationary air emissions sources associated with the proposed Terminal would include the following:

- Three turbine generators, 16,400 horsepower (hp) each
- Two emergency backup diesel generators, 1,100 hp each
- Two firewater pump diesel engines, 1,100 hp each
- Three jib crane diesel engines, 338 hp each
- One diesel storage tank (224,500 gal)
- One sales gas heater (20 million British thermal units per hour [Btu/hr])
- Emergency flare (166,667 standard cubic feet per hour [scf/hr])
- Waste Oil Tanks and Sumps

The mobile air emissions sources associated with the proposed Terminal include the following:

- Four assist tugs
- One supply boat
- One crewboat
- LNGCs
- Helicopters

The assist tugboats used for escorting and mooring the LNGCs at the proposed Terminal would be the primary sources of combustion emissions. Estimates of emissions from project-related equipment, including LNGCs, tugs, supply boats and helicopters, have been included in Table 4-13. These emissions are projected to begin in January 2009.

The proposed turbine generators would be powered by LNG BOG from the LNG offloading and storage, and would supply the electricity to operate the facility. Two of the turbines would be operated continuously and the third turbine would function as a standby unit, effectively using approximately 2 percent for startup maintenance and emergency backup conditions. The three turbines would rotate to standby duty. The backup diesel generators and firewater pump engines would be operated only in event of an emergency, and would be routinely tested/operated approximately 2 percent of the time to ensure successful startup when necessary. Breathing losses and a small amount of working losses of VOCs would occur from the diesel storage tank.

Table 4-13 summarizes the estimated emissions of regulated pollutants from the stationary equipment and mobile sources associated with the operation of the proposed Terminal and pipeline during 2009 and beyond. A detailed description of the emissions factors used, assumptions made, and the air emissions calculations for each criteria pollutant from the Proposed Action is presented in Appendix B of the Deepwater Port License Application for the Gulf Landing Terminal (GL 2003b).

Table 4-13. Stationary and Mobile Source Emissions in 2009 and Beyond

Source Category	Emitted Pollutant (tons per year)				
	PM	SO_x	NO_x	VOC	CO
Operation – Stationary Sources	60.92	5.86	145.18	49.96	171.12
Operation – Moored LNG Tankers	2.15	1.31	11.50	0.84	4.80
Operation – Tug Boats	27.84	113.48	866.49	29.02	192.03
Operation – Supply Boats	0.49	2.27	17.03	0.51	3.71
Totals:	**91.4**	**122.9**	**1040.2**	**80.3**	**371.8**

Source: GL 2003b

Notes: Distance from proposed Terminal to the closest onshore area of the state is 38 statute miles. Stationary sources include the power generation turbines, cranes, emergency generators and firewater pumps, sales gas heater, flare, tank, and fugitive emissions from pipe fittings. Tug boat emissions include tanker escort, berthing, standby, and commute back and forth from the tug's shore berth location.

PM – Particulate matter

SOx – Sulfur Oxide

NOx – Nitrogen Oxide

VOC – Volatile Organic Compounds

CO – Carbon Monoxide

Under normal conditions, there would be no flaring or venting of natural gas. Excess BOG resulting from warming of the stored liquid would be recondensed to LNG liquid and routed back to the storage tanks. Under emergency conditions such as a hurricane, the send-out of natural gas would be suspended, and BOG would be routed to the self-igniting flare. The flare will also operate during the tank cooldown phase at initial startup. Flaring excess BOG will minimize emissions of greenhouse gases from the Proposed Action.

LNGCs would offload product through the four loading arms. At least one of these arms would be dedicated to vapor return during offloading. Emissions of natural gas during product offloading would be collected by a vapor return system in the loading arm and returned to the BOG system.

Tankers would offload LNG at a rate of 12,580 bbl/hr (equivalent to 2,000 m^3/hr). LNG would be stored in the LNG storage tanks at -126 °C (-260 °F) at approximately 1 psig. During LNG transfer operations, vapor displaced from the LNG storage tanks would be returned to the tanker through the vapor arm to maintain pressure in the tanker's cargo tanks. During times when tankers are not offloading, LNG from the Terminal storage tanks would be circulated through the offloading piping system to keep it cool to avoid thermal shock at the beginning of the next LNG transfer.

LNG vaporization would be accomplished by six ORVs. The ORVs would heat the LNG by exchanging heat with sea water. Up to 136 MGD of sea water would be pumped to the ORVs by electric-powered seawater lift pumps and then flow down the outside of the panels. The high-pressure LNG flowing upward through the tubes inside the panels would be warmed to about 1.7 °C (35 °F). The sea water would be cooled and returned to the GOM. The ORVs would have a peak capacity of 2,517 bbl/hr (400 m^3/hr) of LNG each. The ORVs would not be a source of air emissions, because they are a closed system and the lift pumps are powered by electricity.

Air emissions would result from the operation of the gas turbines used for generating electricity on the proposed Terminal. These combustion emissions would consist of NO_x, CO, and small amounts of PM and VOCs. The turbines would be the greatest source of NO_x on the proposed Terminal, but similar combustion emissions would be emitted from the diesel emergency generators and firewater pump engines, and from the diesel cranes and mobile vehicles. The diesel storage tanks would be a minor source of VOC emissions from breathing and working losses. Waste oil tanks and sumps would be a very small source of VOC emissions. The loading arms would be equipped with a vapor return system and would not emit VOCs during offloading operations.

Based on the emissions in Tables 4-10 and 4-11, the PM, SO_x, NO_x, VOC, and CO emissions would not exceed the annual MMS emissions threshold limits from 30 CFR 250.303. Therefore, further emissions modeling would not be triggered if the Proposed Action were regulated under MMS permitting guidelines, and no significant adverse impacts on onshore or offshore air quality would be expected from the Proposed Action.

In addition, based on these emissions rates and the distance to the nearest nonattainment areas 97 km (60 mi) from the Galveston/Houston nonattainment area and 201 km (125 mi) from the Baton Rouge nonattainment area), no adverse impacts on onshore nonattainment areas would be anticipated. This determination is based on a modeling study that modeled maximum O_3 impacts due to OCS petroleum development operations for the August and September 1993 O_3 episodes in the Houston, Beaumont/Port Arthur, and Baton Rouge nonattainment areas (MMS 1995). For these episodes, during periods and at locations where O_3 concentrations were modeled to be greater than the 120 ppb O_3 standard, the incremental O_3 impacts due to OCS petroleum development emissions were estimated to be less than 2 ppb. Therefore, the Proposed Action would not adversely impact the air quality of onshore nonattainment areas.

4.8.2.3 Dispersion Modeling Results

To estimate the onshore significance of potential air emissions from stationary sources at the proposed Terminal, a Lagrangian atmospheric dispersion model was used in the "screening" mode. This conservative screening procedure is designed to result in conservative overprediction of impacts. The modeled impacts are then compared to the ambient air quality modeling significance thresholds to determine whether more refined modeling should be required.

The nonsteady state CALPUFF/CALMET/CALPOST (version 5.7, level 030402) modeling system was used for this modeling effort. CALPUFF has been adopted by USEPA as the preferred technique for assessing long-range transport of pollutants and their impacts on Federal Class I areas. In this instance, the nearest Class I area (Breton National Wilderness Area) is 434 km (270 mi) away; no modeling of impacts at that location was required. Modeling focused on potential impacts at the Louisiana shoreline and on the nearest nonattainment area.

The CALPUFF modeling grid was centered on the proposed Terminal in WC-213. Two rings of discrete receptors at one degree separation with radii of 60.5 km (37.6 mi) (nearest coastline) and 117 km (72.7 mi) (Houston-Galveston Nonattainment Area and Lake Charles) were plotted. Table 4-14 presents the results of the screening-level modeling. Based on these screening results, the potential for significant air quality impacts associated with the proposed Terminal would appear to be low.

Table 4-14. Dispersion Modeling Results

Pollutant	Averaging Period	USEPA Significance Criteria		Modeled Impacts	
		Class II PSD Increments ($\mu g/m^3$)	Modeling Significance Levels ($\mu g/m^3$)	Shoreline ($\mu g/m^3$)	Lake Charles ($\mu g/m^3$)
PM_{10}	Annual	17	1	0.0029	0.0011
	24-hour	30	5	0.0288	0.0124
	1-hour	N/A	N/A	0.1336	0.0425
SO_2	Annual	20	1	0.0002	0.0001
	24-hour	91	5	0.0023	0.0010
	1-hour	N/A	N/A	0.0108	0.0034
NO_2	Annual	25	1	0.0066	0.0026
	24-hour	N/A	N/A	N/A	N/A
	1-hour	N/A	N/A	0.3035	0.0958

Source: GL 2003b

Notes: $\mu g/m^3$ – Micrograms per cubic meter

PM_{10} – Particulate matter equal to or less than 10 microns in diameter

SO_2 – Sulfur dioxide

NO_2 – Nitrogen dioxide

4.8.2.4 LNG Release and Impact on Air Quality

Natural gas is not a criteria pollutant and it does not contribute to the formation of ozone. Therefore, releases of LNG and vaporized natural gas are a safety concern rather than an air quality concern. Although releases of unburned natural gas do not degrade air quality, methane has been identified by USEPA as a greenhouse gas, and releases of this gas are believed to contribute to global warming.

Vaporized natural gas initially is dense and lower in temperature than the surrounding air. In the absence of wind, the dense natural gas vapor cloud would remain near the water surface initially after release. It would rise and disperse as it warmed and become less dense than air (Conrado and Vesovic 2000). It is possible that the vapor cloud could burn. Experience and testing indicate that unconfined natural gas vapor clouds do not explode. However, the vapors could be ignited if they come within their explosive range (5 to 15 percent concentration of natural gas vapors in air) and an ignition source is present. LNG does not burn, but natural gas vapors above the LNG could burn until the LNG or natural gas vapors are fully dissipated. The duration of time in which potential impacts could occur is based on modeling results of a catastrophic LNG release from a tanker, indicating that for a 5-m (16.4-ft) hole in a ship, the time to burnout of the spill vapor was 37 minutes. For a slower leak, through a 1-m (3.28-ft) hole, the time to burnout was 64 minutes. In both cases 2,322 m^3 (82,021 ft^3) of LNG were released (Juckett 2002).

4.8.2.5 Pipeline Operations

Operation of the pipeline would not result in substantial air emissions under normal operating conditions since the pipeline would be installed underground and underwater and is a closed system. Typically, only minor emissions of natural gas, called fugitive emissions, occur from pipeline connections at aboveground locations. Because such emissions are typically very small, they are not regulated by permit or source-specific requirements. A Leak Detection and Repair program that is intended to minimize the release of pollutants would control these fugitive emissions. Pump and compressor seals, valve stems, and pipeline fittings would be monitored regularly using an organic vapor analyzer to confirm that VOC emissions were below permissible levels. Any leaks found would be repaired and would be subject to more rigorous monitoring until fugitive emissions were reduced. A minor release of natural gas to the water is unlikely to present any significant air impact. The extent of the impact would depend not only on the size of a release but also on wind and water conditions at the time of a release.

4.8.2.6 Applicable Regulations and Controls

NSPS. The proposed gas turbines would be 16,400 hp each with a heat input of approximately 150 million Btu/hr, based on the lower heating value of the fuel. As a result, the NSPS emissions standards promulgated in 40 CFR 60.330, Subpart GG, would apply to these proposed turbines. The control requirements associated with these NSPS standards have been incorporated into the design and specifications of this equipment and would be enforced by the Title V permit issued by USEPA for the facility.

Due to recent revisions to the applicability criteria for tank NSPS, 40 CFR Part 60, Subpart K, the 225,000 gal diesel storage tank would not be subject to the NSPS requirements. The LNG storage tanks would also not be subject to NSPS requirements.

Title V. Based on the stationary source emissions estimates presented above, the proposed Terminal would require a Title V operating permit. At the request of USEPA Region 6, the Applicant submitted a Part 71 Title V permit application in October 2003.

4.8.2.7 Mitigation

If approved, conditions of the License would require the applicant to obtain all applicable and appropriate air quality permits prior to initiating port operations. The Licenses would require all monitoring and compliance requirements associated with the Ports air permits to be met during the operating life of the facility.

4.8.3 Alternate Site Location (WC-183)

WC-183 is approximately 47 km (29 mi) from the Louisiana coast, compared to 61 km (38 mi) for WC-213, the preferred location. Construction and operational emissions, and the resulting total impact on local and regional air quality would be virtually identical to that of the Proposed Action. This Alternative

Site Location would be subject to the same Title V permitting requirements and mitigation measures as the Proposed Action. If this site were selected for the proposed Port, site-specific air modeling would be required to identify any unanticipated impacts. If approved, a License issued for this site would have the same air permitting conditions as would apply to the WC-213 location.

4.8.4 No Action Alternative

Under the No Action Alternative, the Secretary would deny the license application, preventing construction and operation of the proposed Port. If the Secretary pursues the No Action Alternative, potential short- and long-term environmental effects on air resources identified in Section 4.8.2 of this EIS would not occur. Existing conditions would prevail and there would be no contribution to the Nation's natural gas supply from this source. Because of the existing and predicted demand for natural gas it would be necessary to find other means to facilitate the importation of natural gas from foreign markets that would equal the contribution from the proposed Port. Strategies to meet this need could include other deepwater port applications, expansion of existing or construction of new onshore LNG ports, or increased use of other energy sources. Increased use of alternative fossil fuels, such as oil or coal, would generally result in higher emissions rates of NO_x and SO_2 than would be the case with natural gas. To comply with current air emissions regulations, emissions control technologies could be required that could limit the economic viability of projects using these alternative fuels.

4.9 Noise

4.9.1 Evaluation Criteria

This section addresses the noise impacts from the Proposed Action. Examples of noise impacts from the Proposed Action could include noise from aircraft, vessels, construction equipment (temporary), and industrial equipment such as pumps and generators. Anticipated noise impacts resulting from the Proposed Action can be generated through the air or water. Specific noise impacts on biological resources are discussed in Section 4.2.

Noise impact analyses typically evaluate potential changes to existing ambient noise levels that would result from implementing a proposed action. Potential changes in the ambient noise levels can be beneficial (i.e., if they reduce the number of sensitive receptors exposed to unacceptable noise levels), negligible (i.e., if the total area exposed to unacceptable noise levels is essentially unchanged), or adverse (i.e., if they result in increased noise exposure to unacceptable noise levels). Projected noise impacts were evaluated for the Proposed Action.

While no absolute standards define the threshold of "significant adverse impact," there are common precepts about what constitutes adverse noise in certain settings, based on empirical studies. Noise is "adverse" in the degree to which it interferes with activities (such as speech, sleep, and listening to the radio and television) and the degree to which human health might be impaired.

Noise impact criteria can be based partly on land use compatibility guidelines and partly on factors related to duration and magnitude of the noise level itself, including the time of day and conduct of operations. The FAA has adopted noise limits, or standards, for various categories of aircraft and helicopters. These FAA limits may be used in this section for comparison purposes but not as significance thresholds.

4.9.2 Proposed Action

Long- and short-term minor adverse effects on the noise environment would be expected. These impacts would arise in facilities construction, installation, and operation.

4.9.3 General Construction Impacts

Construction activities related to the Proposed Action would result in minor adverse impacts on existing ambient noise levels in the GOM. Noise would be typical of other OCS structure and pipeline projects in terms of schedule, equipment used, and types of activities. The Proposed Action would not require seismic surveys. Seismic surveys are a significant source of noise in the GOM. It is expected that construction of the proposed facilities would increase noise levels in the vicinity of the proposed Terminal and pipeline corridors. No onshore noise-sensitive areas would be affected since the project area would be 22.5 to 61 km (14 to 38 mi) offshore. Any impacts would be minimal and temporary.

The proposed pipeline construction would be accomplished within 5 months from initiation. Construction equipment would be operated on an as-needed basis during this period and would be maintained to the manufacturer's specifications to minimize noise impacts.

4.9.4 Operational Impacts

Operational activities related to the Proposed Action would result in minor adverse impacts on the existing ambient noise levels in the GOM. Noise from the Proposed Action's activities would result from the machinery on the proposed Terminal, operation of the proposed pipelines, and vessel traffic related to the proposed Port. Because noise impacts occur only on a localized geographic scale, it is not possible to provide numerical noise level estimates that would represent noise impacts at a systemwide or regional scale. The Proposed Action would result in 135 new LNGC trips, 540 new tug trips, and 26 new helicopter trips per year. Noise impacts from the proposed Terminal operations offshore could impact biological resources, and are discussed in more detail in Section 4.2.

Proposed Terminal. Machinery noise generated during the operation of fixed structures would vary in duration and intensity, and be similar to noise generated by fixed oil and gas structures. Underwater noise from fixed oil and gas structures ranges from about 20–40 dB above background levels, and has a frequency spectrum of 30–300 Hz at a distance of 30 m (98.4 ft) from the source (MMS 2002a). Noise generated at the proposed Terminal and along the proposed pipelines would not affect noise-sensitive areas onshore due to the distance from shore.

Proposed Pipelines. The five pipelines would be buried to provide a minimum 91 cm (36 in) of cover below the sea floor. Operation of the pipelines would not be a significant source of noise to either the human environment or to marine mammals.

Vessel and Helicopter Traffic. Data on airborne noise generation by marine vessels generally are not available. Most vessel operations occur offshore. Hence, airborne noise from marine vessel operations is rarely a concern. It is generally recognized that commercial shipping is a dominant component of the ambient, low-frequency background noise in modern world oceans, and that OCS-related, service vessel traffic would contribute to this background noise.

Noise generated from helicopter and service-vehicle traffic is transient and extremely variable in intensity, depending upon the source. Service vessels transmit noise through both air and water. The source of vessel noise is mechanical, from propulsion and generator machinery, and from hull noise generated during transit (MMS 1994).

Support vessels and helicopters would have potential to impact noise-sensitive areas onshore. Ports are typically located in port/industrial areas where vessel and mechanical noises do not normally affect the community; therefore, there would be no significant impact from existing or proposed vessel noises. Most high-speed vessel operations would occur well offshore and have little impact on noise levels at onshore locations. Given the amount of vessel traffic from all sources in the GOM, the contribution of noise from offshore vessels is a minor component of the total ambient noise level (MMS 2002a).

The Proposed Action would include an increase in vessel traffic (e.g., approximately 135 LNGC trips per year and 540 tug trips). In addition, there are numerous mud docks in Cameron (e.g., Bariod, Baker, Hughes, Ambar) that can be used to load and unload supplies for the Gulf Landing offshore facilities. It is anticipated that the proposed Port would not have dedicated supply vessels but would receive its supplies during normal offshore platform supply runs by local supply contractors or from the attendant tug boats visiting the Terminal (GL 2003a).

Most of the Proposed Action would occur offshore and, therefore, out of earshot of most communities on the mainland. Aircraft operations in support of OCS activities, however, involve landings and takeoffs that generate high levels of noise at or near airports onshore. The FAA imposes use regulations on takeoffs and landings from airports, including strict flight paths diverting aircraft away from sensitive resources, limitations on engine run-ups before takeoff, and noise surcharges. Municipalities that border airports also issue land use regulations regarding noise that are often drafted in collaboration with airport authorities and the FAA. The Proposed Action would include four to five helicopter trips from an existing heliport in Cameron, Louisiana.

4.9.5 Mitigation

No mitigation measures would be required as a result of the Proposed Action.

4.9.6 Alternate Site Location (WC-183)

Siting of the Gulf Landing Port in WC-183, approximately 13 km (8 mi) north of WC-213, would result in impacts similar to those expected to occur in the Preferred Alternative. Siting at WC-183 would require slightly different approach and departure routes to and from the Terminal for LNGCs using the Calcasieu Fairway. Given the short distance involved, however, the differences would be negligible. Impacts on other aspects of noise are expected to be similar to those of the Proposed Action. The greater number of active platforms in the vicinity of WC-183 could be indicative of greater existing ambient noise at this location. Additional noise associated with installation and operation of the Alternative Site at WC-183 might have less relative impact on ambient conditions than ambient noise impacts at WC-213.

4.9.7 No Action Alternative

Under the No Action Alternative, the Secretary would deny the license application preventing construction and operation of this deepwater Port proposal. If the Secretary pursues the No Action Alternative, potential short- and long-term environmental effects associated with noise identified in Section 4.9.2 of this EIS would not occur. Existing conditions would prevail and there would be no contribution to the Nation's natural gas supply from this source. Because of the existing and predicted demand for natural gas it would be necessary to find other means to facilitate the importation of natural gas from foreign markets that would equal the contribution from the proposed Port. Strategies to meet this need could include other deepwater port applications, expansion of existing or construction of new onshore LNG ports, or increased use of other energy sources.

4.10 Risk Management

4.10.1 Evaluation Criteria

The transportation, storage, and processing of LNG and transportation of associated natural gas requires strict controls to minimize potential risks and interruptions of gas supplies. This section provides an overview of issues that would affect the safe and reliable operation of the proposed Port. This section is limited to design, engineering, and operational components of the proposed Port infrastructure that directly or indirectly have the potential to impact public safety. Reliability of overseas LNG supplies and shipping is outside the scope of this EIS.

The Applicant has proposed the Port as an uninterrupted source of natural gas operating 24 hours a day, 365 days a year. If the license is approved, the USCG would review and approve all design, engineering, operations and security specifications prior to construction and operation of the proposed Port. The USCG's review would include a thorough evaluation of the Applicant's measures to manage safety risks. Relevant standards applicable to onshore LNG facilities would also be applied to the proposed Port.

The analyses of safety and operational reliability apply equally to the WC-213 and WC-183 sites.

4.10.2 LNG Hazards

LNG is approximately 95 percent methane (natural gas) in liquid form. When the gas is cooled to minus 162 °C (-260 °F) it decreases in volume and becomes a clear and odorless liquid. LNG is transported and stored at near atmospheric pressures. As the liquid vaporizes and expands to form a gas a pressure slightly above atmospheric pressure is maintained. This elevated pressure precludes air from entering the storage container.

LNG has several physical properties that are of interest:

- LNG is not toxic but can act as an asphyxiant by displacing air.
- When initially released, LNG vapor will remain heavier than air until it warms up.
- Methane gas at normal temperature is lighter than air.
- Methane gas occupies 625 times more volume than LNG (methane liquid).
- When mixed with air, natural gas is flammable within the range of 5–15 percent.
- LNG has the highest auto-ignition temperature when compared to other fuels (e.g. LPG, gasoline, and diesel).
- When spilled on water, a physical phenomenon, not involving combustion, called Rapid Phase Transition (RPT) explosion, can occur as the methane rapidly transitions from its liquid phase to its gas phase.

Regardless of the cause, the formation of a methane/air mixture and its movement depends on the quantity and rate of the spill, whether it is on land or water, the atmospheric stability, the wind direction and velocity, and the temperature of the atmosphere and water.

There are several major hazards associated with LNG that could have significant impacts over wide areas. Several studies have been conducted for existing LNG terminals; they have determined three areas of concern for potential catastrophic events:

- Flammable vapor clouds form if the spill is not immediately ignited.
- Pool fires could occur on the surface of water or impervious surfaces.
- RPT from rapid mixing of LNG and water.

When exposed to the atmosphere, the LNG, initially at 162 °C (-260 °F), cools the air it mixes with forming a heavy, cold cloud much of which is visible because of the condensed moisture. Although methane gas, the principle constituent of LNG, is buoyant (less dense than air) at temperatures of above 162 °C (-260 °F), the cold air-LNG gas mixture is not. During this stage, most of the plume growth would be entrained into the cloud so that its dispersion is governed solely by ambient turbulence (USEPA 1988). In the LNG cloud the level of mixing will no be uniform, and pockets of flammable gas might exist in regions of the cloud, which are generally outside the flammability limits of methane (Parry and Koliopulos 2002). If this flammable plume finds an ignition source, a fire would flash back to the source of the emission, causing potentially serious burns to those individuals outdoors in the flammable concentration zone. Thermal radiation (the heat that is felt when standing in front of a fireplace) is the primary mechanism of heat transfer from the burning methand to an individual or structure (USCG and MARAD 2003b). When LNG vaporizes from its liquid state to its gaseous state, the methane concentration is too high so there is insufficient oxygen present to support combustion. When the amount of vapor decreases to 15 percent of the vapor/air mixture, it will burn (15 percent methane, 85 percent air). This is the upper flammability limit. As the vapor continues to mix with more of the surrounding air its concentration drops. When the mixture is diluted to below five percent methane (5 percent methane, 95 percent air) it becomes too lean to burn, this is known as the lower flammability limit (LFL). When an unconfined cloud of natural gas and air burns in the open, the flame spreads from the ignition source over the surface of the LNG vapor cloud. The flame's rate of spread is only a few miles per hour. This flame speed is too slow to generate an explosion. Instead the flame will burn back to the source and the primary concern is the radiant heat generated from the fire and the flames themselves. For LNG to cause an esplosion the vapor cloud must be confined. A literature search revealed no recorded unconfined vapor cloud explosion involving methane. Large scale field tests involving releases of methane into the open air or onto water will not explode if ignited. Any methane that does not burn after being diluted below its lower flammable limit will dissipate into the atmosphere.

Any large release of LNG from the Terminal could result in a pool fire. In the event of a release of LNG a large pool could form prior to ignition and this is likely to be the highest risk in terms of a damage radius. However, all modeling to date concludes that the distance that a cloud could migrate before being diluted to below LFL is less than 8 km (5 mi) (See Tables 4-16, 4-17, 4-18). The proposed Port is 61 km (38 mi) offshore minimizing the potential risk to the general population (see Figure 4-1).

RPT occurs when a very cold liquefied gas strikes a warmer surface. LNG will exhibit this "rapid phase transition" if spilled onto water. In some cases, the rapid uncontrolled expansion of LNG as it changes phase from a liquid to gas could result in an explosion caused by the physical energy released during the rapid expansion of the liquid to gas (Lees 1996). Since 1981, there have been several projects sponsored by the Society of Petroleum Engineers (SPE) to investigate and develop a methodology for producing quantified estimates of the risk associated with the RPTs. Progress from this work is reported monthly in the *Journal of Petroleum Technology* (JPT). The hazard zones extending from an RPT would not be as large as either vapor cloud or pool fire hazard zones. RPT accidents are probably the lowest concern of the three mentioned here (Havens 2003).

A controversial, potentially potential major, LNG hazard is called a Boiling Liquid Expanding Vapor Explosion (BLEVE), which is an explosion that results from any failure of a storage tank, containing a liquid at a temperature significantly above its boiling point at normal atmospheric pressure that leads to a release that leads to a release (CCPS 1994). A BLEVE can occur even if the liquid is not flammable.

The effects from the BLEVE depend on conditions of the material in the tank when it fails and the actual tank failure mechanism. The most common cause of a BLEVE is an external fire that weakens the tank wall above the liquid surface inside the tank. Other less common causes include corrosion and metallurgical failure, and mechanical impact severe enough to rupture the container (these causes do not require any secondary failures). Another cause pertinent to LNG is excessive internal pressure (i.e. loss of insulation) combined with inadequate venting pressure protection. Most LNG experts have dismissed BLEVE as being a noncredible event. There have been no reports in the literature reviewed of any BLEVE incidents occurring with LNG.

Regarding worker safety, potential hazards include exposure to low temperature LNG and asphyxiation by concentrated vapors. The low temperature is sufficient to cause rapidly the equivalent of frostbite, or if enough of the body surface is exposed, death via freezing of the tissue. The timeframe for these potential impacts is limited.Even though the LNG cloud is not toxic, the cloud may displace enough air to make the atmosphere unsafe for humans to breathe. This represents a hazard to the personnel in close proximity to the release, especially if there is some confinement that traps the vapor and allows the concentration to buildup in the area.

As a cryogenic liquid, LNG quickly cools the materials it comes into contact and causes extreme thermal stress in materials not specifically designed for ultracold conditions. These thermal stresses can cause brittleness, or loss of tensile strength and possible fracture of common materials of construction (FERC 2003).

Roll-over is another hazard that can occur with LNG. This occurs when different mixtures of LNG having significantly different densities are allowed to separate into distinct layers. Eventually the layers equalized with an increased vaporization rate. Certain LNG handling equipment depends on a predictable vaporization rate. Unpredictable vaporzation rates could result in dangerous pressures unanticipated relase of LNG or natural gas.

4.10.2.1 The Public Hazard

Only large flammable clouds drifting into an area available to the general public and then igniting would offer a potential threat to the public from LNG. Based on the previous modeling done over the past several years and a review of incidents involving LNG, this potential concern does not exist for these facilities. This is due to the location of these facilities which is 38 miles outside the hazardous envelope for the LNG releases (See Tables 4-16 and 4-17).

Since LNG is not toxic, there are only two major hazards that could affect people not involved in Terminal operations—a large pool fire spreading far enough to reach a public area or a flammable cloud drifting into an area available to the general public and then igniting. Based on the modeling of the migration of pools and clouds of LNG and a review of incidents involving LNG, this is not a concern facilities for the proposed Port. The proposed Port is 61 km (38 mi) offshore placing the public more than 48 km (30 mi) away from the hazardous envelope for the LNG releases (see Figure 4-1 and Tables 4-16 through 4-19).

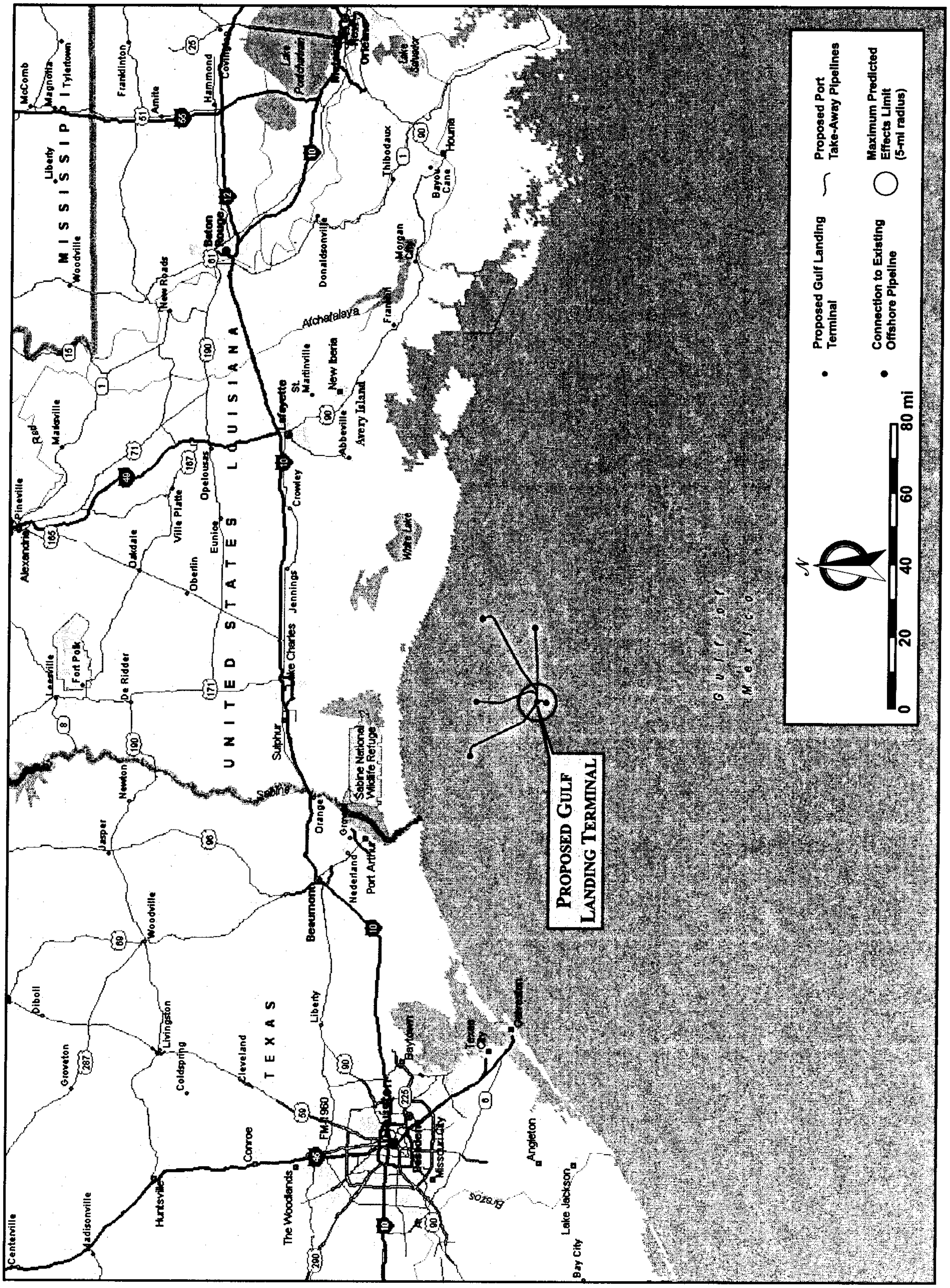

Figure 4-1. Maximum Predicted Limit of Measurable Effects From Worst-Case Accident Scenario for Proposed Gulf Landing Terminal

4.10.2.2 The Local Impacts

LNG is less dense than water. If spilled into water or onto the GBS deck, it would boil rapidly when exposed to the warmer ambient temperature. Because of the material's density and turbulence created by the rapid boiling, an LNG spill would spread and vaporize rapidly. Due to the low boiling temperature of LNG, the formation of ice is possible; however, ice formation has not been observed in field experiments. The recently released FERC report covering recommended modeling approaches for LNG releases from LNGCs. The FERC report recommends that ice formation should not be considered when modeling LNG spills on water. If LNG is spilled on water but not ignited immediately or soon after the spill, the LNG will evaporate. The vapor will mix with air and move downwind. The resulting vapor cloud could cause a flash fire if ignited before it is diluted below the LFL. Personnel working at the Terminal could be affected by the fireball or by exposure to the thermal radiation.

Although very unlikely, this event could affect ships passing through the Calcasieu Fairway shipping lane which is about 3.5 km (2.2 mi) east of the Terminal. Ships that are approaching the dangerous area would certainly attempt to avoid the area before any damage could occur. If a ship was in the danger area when the event occurred, the fireball or thermal radiation could affect it and its personnel. But it is likely that the onboard personnel would immediately seek cover once the fire was apperent. Also the likelihood is very small that both events would occur simultaneously.

As a cryogenic liquid, LNG quickly cools materials it comes into contact with and causes extreme thermal stress in materials not specifically designed for ultracold conditions. Such thermal stresses can cause brittleness or loss of tensile strength and possible fracture of common materials of construction (FERC 2003). This could cause failure of on-board equipment that could present hazards to GBS personnel. Worker safety can also be threatened by exposure to low temperature LNG and asphyxiation by concentrated vapors, as noted above. These are localized hazards that would affect nearby personnel only.

Experience and testing indicate that unconfined natural gas vapor clouds do not explode. As the degree of confinement and congestion in the area surrounding the leak increases, the potential to explode rather than to flash also increases (Lees 1996). In all cases, LNG vapors must be within the flammable range and an ignition source must be available (Juckett 2002). In the absence of an ignition source, a potentially flammable plume would migrate from the LNG leak source until the leak is isolated or LNG supply is exhausted and the air dilutes the concentration of natural gas to below the LFL. Due to the physical properties of natural gas, the gas cloud would quickly become buoyant. This has been confirmed by historical events and dispersion modeling (i.e., a release of 25,000 m^3 [6,600,000 gal]) of LNG would generate a flammable plume for a maximum distance of less than 4.8 km (3 mi) (see Tables 4-16 and 4-17). The ignited cloud would be extremely hazardous to personnel working at the Terminal by the fire itself or by exposure to thermal radiation.

Environmental hazards associated with a spill of LNG. The low temperature of the material could adversely impact marine life in close proximity to the liquid. However, because LNG does not dissolve in water, no residual hazards are expected after the LNG has boiled off and the vapors have dispersed.

LNGCs

LNG vessels are well constructed with spill and accident prevention measures incorporated into equipment design, operations, and safety training (FERC 2001). The transportation of LNG by ship has proven to be an extremely safe method since the first LNG maritime shipment in 1959. Commercial maritime shipments of LNG began shortly thereafter-in 1964. In 1980, the USCG published *Liquiefied Natural Gas and Liquiefied Petroleum Gas – Views and Practices – Policy and Safety*, in which it determined that the level of risk associated with LNG maritime transportation is acceptable. More than 30,000 shiploads have traveled over 100 million km (62 million mi) while loaded, with no recorded fatalities to vessel crew or the general public and no recorded fires on deck or within cargo areas. Out of the greater than 30,000 shipments of LNG since 1964, only 30 incidents have been reported, involving LNG leakage. The most significant damage resulting from LNG leakage involved a deck or plating fracture from low-temperature embrittlement (CH-IV International 2002). Eleven of the incidents involved a vessel collision, a vessel running aground, or vessel fracture due to high seas deflection stresses. None of these 11 incidents resulted in the spill of LNG (CH-IV International 2002).

As of 2000, the world's LNG fleet comprised of 124 active LNG vessels with another 23 LNG vessels on order. The LNG capacities of these ships have a range from 674,500 to 4,860,300 ft^3 (19,100 m^3 to 137,600 m^3). All of these LNG vessels operate (or intend to operate) under a foreign flag with foreign crews and must have a Letter of Compliance inspection from the USCG to verify compliance with international safety standards. These ships are required to have an operations plan written in English and at least one officer fluent in English that is knowledgeable of the cargo systems aboard at all times (USCG and MARAD 2003b).

LNG could be released if a LNGC were to collide catastrophically with the Terminal. However LNGC transit to the Terminal, docking at the Terminal or anchoring in the vicinity of the Terminal would be strictly controlled as discussed in Section 1.10.6. Additionally, the LNG tanks of the Terminal are designed with two protective walls of reinforced concrete to prevent breaching of the tanks in the unlikely event of a collision by an LNGC.

The U.S. Department of Energy (DOE) also pointed out that it would be highly unlikely that a collision with the LNG vessel capable of breeching all four protective barriers would occur without creating an ignition source. This ignition source would be close to the vessel and a burndown of the released material would be localized to the proximity of the vessel (DOE 2002).

Onboard Release of LNG

The most-likely, worst-case accident from the operation of the proposed deepwater Port would be the onboard rupture of an LNG line running to one of the Terminal's vaporizers. With an LNG flow rate of 18 kg/s (40 lb/s), and an estimated 30 seconds for detection and an additional 30 seconds for shutdown, approximately 1,088 kg (2,400 lb) of LNG could be released. Such a release would pool in the stainless steel sumps below the cryogenic LNG line running to the vaporizers. The sumps would be constructed of stainless steel to handle the cryogenic affects of LNG. The capacity of the containment sump area is approximately 2,822 kg (6,221 lb), more than three times the projected release quantity. The LNG pooled in the sumps would almost immediately begin to vaporize and disperse.

Land Based LNG Facilities

To date there are no deepwater LNG ports operating, so there is no historical data directly associated with deepwater LNG port safety. Therefore, this EIS will include a review safety records from land based LNG facilities. In all, there have been only seven documented incidents with one or more fatalities connected directly to LNG at operating, land-based LNG facilities: Skikda, Algeria, January 2004; P.T. Badak, Bontang, Indonesia 1983; Cove Point, Maryland, 1979; Arzew, Algeria, 1977; Texas, U.S., 1973; Raunheim, Germany, 1966; and Cleveland, Ohio, 1944. Table H-1 in Appendix H summarizes the major hazardous incidents that have occurred in land-based LNG facilities (peak shaving plants, liquefaction/export facilities, and import/regasification terminals). This list is limited to incidents that resulted in serious injuries or fatalities.

4.10.3 Risk Management Planning

There is some inherent risk associated with any industrial complex handling materials with potentially dangerous characteristics. Gulf Landing has proposed to develop a risk management plan that would identify, assess, and control potential risks. This planning would include mechanisms to minimize the effects of and facilitate recovery from unintended incidents. The individual stages Gulf Landing LLC proposes to use in this process are

- Identify hazards and potential effects
- Evaluate risks
- Record hazards and effects
- Compare with objectives and performance criteria
- Establish risk reduction measures

4.10.3.1 Hazardous Events

Some of the potential hazard scenarios identified by a preliminary assessment of the Proposed Action include

- LNGC leaks and failures
- LNGC discharge of natural gas from emergency vent
- LNG transfer system leaks and failures
- Incidents affecting the GBS LNG tank domes
- Leaks from the low-pressure LNG storage and pipe work system
- Leaks from the high-pressure LNG pumps and vaporizers
- Leaks from the high-pressure metering, natural gas pipe work, and risers
- Vessel collisions
- Terrorist threats

4.10.4 LNG Accident Modeling

To help evaluate potential risks associated with an uncontrolled LNG release from the proposed deepwater Port, the Applicant evaluated three scenarios described in literature made public from the following sources:

- DOE Worst-Case Reassessment
- Ronald P. Koopman, Ph.D
- James A. Fay

A discussion of these models is presented below.

4.10.4.1 DOE Worst Case Reassessment

Following the September 11, 2001 terrorist incidents, LNG tanker dockings were suspended in Boston Harbor. Subsequently, in October 2001, DOE, along with FERC, USDOT Office of Pipeline Safety (OPS), and local and state officials, commissioned Quest Consultants, Inc., (Quest) to reevaluate existing data being used by the agencies to evaluate theoretical "worst case" LNG releases associated with LNG ports. The results of the Quest study were made available in public presentations by Don Juckett of the DOE.

The scenario evaluated by Quest involved the catastrophic breaching of a single tank of an LNGC typical of those servicing terminals in the United States. Two types of spills were modeled—a 5-m hole and 1-m hole in the tank. Both spills were characterized by a loss of the entire contents of the tank, 25,000 m^3 (880,000 ft^3) of product.

The study indicates that unignited spills could travel over large distances. For spills on water without ignition, maximum distances for flammable vapor clouds were calculated by Quest using its CANARY model. Two different types of atmospheric conditions were modeled—very stable with wind conditions of 1.5 m/s (Pasquill-Gifford stability "F"), and less stable with winds gusting to 5 m/s (stability "D"). As shown in Table 4-15, distance to the LFL varied considerably depending on atmospheric stability.

Table 4-15. LNG Dispersion Modeling

Hole size	Wind Speed	Atmospheric Stability	Liquid Impoundment	Distance to LFL
5 meters	1.5 m/s	F	No	2.5 mi
5 meters	5 m/s	D	No	0.6 mi
1 meter	1.5 m/s	F	No	2.3 mi
1 meter	5 m/s	D	No	0.5 mi

Source: Juckett 2002
Notes: m/s – meters per second
mi - miles

Quest concluded that if the large release scenarios presented in the study were to occur, the most likely outcome of such a release would be the near instantaneous ignition of the flammable vapors that would result in a rapid flash fire followed by a large pool fire (Juckett 2002). As shown in Table 4-16, Quest calculated radiation hazards for the two spill scenarios using three distances to radiation levels. The calculations presented in Table 4-16 are based on a wind speed of 9 m/s (20 mph), which was considered a worst-case atmospheric condition for pool fires, since high winds bend the flame and create longer down-wind distances.

Table 4-16. Distance to Radiation Levels and Fire Durations

Hole Size	Distance to Radiation Levels			Fire Duration
	7,000 $Btu/hr/ft^2$	4,000 $Btu/hr/ft^2$	1,500 $Btu/hr/ft^2$	
5-m	1,020 ft	1,260 ft	1,770 ft	34 minutes
1-m	835 ft	1,020 ft	1,420 ft	74 minutes

Source: Juckett 2002

The Quest study found that the 5-m hole took 34 minutes to burn out of the spill. For a slower leak through a 1-m hole, the time to burn out was 74 minutes. Other conclusions from the report are as follows:

- Modeling results showed the natural gas cloud dispersing to a distance of 3 to 6 km (1.8 to 3.7 mi)
- Exposure at 300 m (1,000 ft) from a pool fire would cause pain within 60 seconds
- As the gas warms, the cloud would become lighter than air and rise
- No direct environmental damage or cleanup from the primary spill occurred

Ronald P. Koopman

In December 2002, the Vallejo, California Disaster Council's LNG Health and Safety Subcommittee retained Ronald P. Koopman, Ph.D. to advise them on LNG spills, fires and dispersion as part of the sub-committee's review of a terminal being evaluated for Mare Island. A summary of Dr. Koopman's dispersion results is presented in Table 4-17.

Table 4-17. LNG Dispersion Distances to LFL

Scenario	Spill Size	Wind Speed	Atmospheric Stability Class[1]	Distance to LFL[2]
Unloading Line Failure	55,000 GPM spills for 10 minutes onto water	5 m/s	D	0.4 miles
LNG Tanker Ship Collision	Rupture of one 25,000 m^3 tank, spills onto water 1-m hole in tank.	5 m/s	D	0.7 miles
LNG Tanker Ship Collision	Rupture of one 25,000 m^3 tank, spills onto water 5-m hole in tank	5 m/s	D	1.5 miles
LNG Tanker Ship Collision	Rupture of one 25,000 m^3 tank, spills onto water 5-m hole in tank	2 m/s	F	2.8 miles

Source: GL 2003a

Notes: [1] D: neutral

F: stable

[2] Lower Flammability Limit (the concentration range where methane concentration in air is flammable)

For an ignited release for a 5-m hole in one of the 25,000 m^3 (880,000 ft^3) LNGC tanks, the distances to various levels of harm were calculated by Dr. Koopman as shown in Table 4-18. The hazard distances are defined by the distance from source where the concentration of methane in air is flammable.

James A. Fay

Professor James A. Fay has published numerous articles on LNG safety. His latest article on models of spills and fires from LNG and oil tankers in the Journal of Hazardous Materials (B96, 171-188) and his article on spill and fires from LNG and oil in Boston Harbor address a scenario comparable with the ones discussed by Juckett and Koopman (Fay 2003).

Table 4-18. Estimates for LNG Pool Fire Effect Distances

Radiation Level	Distance	Description of Effect
Distance to Third Degree Burns	0.35 miles	Lethal 50 percent of the time for a person wearing average clothing. Heat flux of about 30 kw/m^2 (10,000 Btu/hr/ft^2) for 30 seconds
Distance to Second Degree Burns	0.5 miles	Lethal 1 percent of the time for a person wearing average clothing. Heat flux of about 17 kw/m^2 (6,000 Btu/hr/ ft^2) for 30 seconds
Distance to Skin Blister Threshold	0.8 miles	no lethal effects

Source: GL 2003a

According to Mr. Fay's article, the hydraulics associated with the DOE's "worst case" LNG release in Boston Harbor, would prevent the entire 25,000 m^3 (880,000 ft^3) of LNG in the tank from being released. A more realistic release scenario would be a spill of approximately 14,300 m^3 (505,000 ft^3) which would result in a fire duration of 3.3 minutes with a pool radius of 340 m (1,115 ft) and a distance to 5 kW/m^2 (1,600 btu/hr/ft^2) of 1.1 km (0.7 mi) (GL 2003a).

The results presented in Mr. Fay's article supported the distances at the 5 kW/m^2 (1,600 btu/hr/ft^2) radiation level used by Quest in their model calculations. "For human skin exposure to flame thermal radiation, a thermal flux of 5 kilowatts per square meter (kW/m^2) will result in unbearable pain after an exposure of 13 seconds and second degree burns after an exposure of 40 seconds. Exposure to twice that level, 10 kW/m^2 for 40 seconds is the threshold for fatalities. Wood can be ignited after 40 seconds exposure at a thermal flux of 5 kW/m^2 (1,600 btu/hr/ft^2)."

- Based on the risk evaluation presented in the application, it appears that there is a relatively large deviation in the dispersion distances, distances to certain levels of radiation and assessment of the vulnerability of people presented in the publicly available literature.
- A review of the available data indicates that a majority of the results used in the existing LNG spill evaluations are assumptions and the actual models used are not documented.
- Unignited LNG spills and dispersion would not result in residue, direct environmental damage, or clean-up requirements.

4.10.5 Extreme Weather and Sea Conditions

Storm surge would probably be severe at the proposed Terminal due to its close proximity to the coast and shallow depths of water. Modern high-strength cement technology and steel reinforcing would be used to design the GBSs to safely withstand extreme environmental loads realized in the GOM, including severe wave loads caused by hurricanes and other energy-imparting events such as vessel impact. A wind speed of 20 knots would probably define conditions that might limit Terminal LNG unloading operations, yet regasification processing could operate at higher wind speeds. The definition of extreme weather and sea conditions and specific operational responses would be identified in the Port Operations Manual. If approved, the License would require the USCG to review and approve this plan prior to implementation.

4.10.6 Terminal Facility Safety Controls

If the USCG and MARAD approve a deepwater Port License for the Proposed Action, it would be conditioned to require the USCG to review and approve design, engineering, and operations specifications prior to construction and operation of the proposed Port. These approvals would be contingent on the Applicant's compliance with all applicable and appropriate guidelines, regulations, and specifications as directed by the USCG.

General infrastructure features proposed by the Applicant to minimize risk include

- GBSs would be constructed of high-strength cement with steel reinforcing to specifications necessary to protect the personnel, processes, and LNG storage tanks from the extreme environmental loads realized in the GOM, including severe wave loads caused by hurricanes, and other energy-imparting events such as vessel impact.
- ORVs require no combustion for the regasification of LNG. The Applicant considers ORVs extremely safe, since no moving parts are in contact with flammable liquid. This technology might be the most popular of all measured by number of units in service worldwide. A 1997 report, *World LNG Source Book* indicates that at least 50 percent of the vaporizers (excluding peak shaving facilities) are ORVs (USCG undated).
- LNG storage tanks generally consist of a multiple containment system. As discussed in Section 2.2.2, Gulf Landing LLC has postulated use of the prismatic membrane tank system but, at the time of application submission, had not finally selected the type of tank system ultimately to be employed. Final selection of the Terminal's storage system would require compliance with all applicable and appropriate guidelines, regulations, and specifications as directed by the USCG.

In accordance with 33 CFR 150, the licensee of a deepwater port may not operate the port without prior USCG approval of the Port Operations Manual. The License would require that the Port Operations Manual address the requirements of the Deepwater Port Act and provide detailed specifications and procedures for all aspects of port operations and infrastructure including navigation, vessel movement, materials handling, safety, and protection of the environment. The Port Operations Manual would be required to address Port requirements for calling vessels, approaches, Safety Zones, port infrastructure, and pipelines to existing receiving/distribution points.

If the proposed Port is approved and commences operations, USCG would conduct regular inspections of the port facility to ensure that the Port Operations Manual is being properly implemented. In addition, the USCG may review the Port Operations Manual at any time and propose or require amendments as necessary to meet the intentions of the appropriate regulations.

4.10.7 Marine Safety

While in the shipping channels and on the open sea, LNGCs are subject to all domestic and international maritime laws, standards, and regulations. The proposed support vessel traffic would be required to operate at all times under USCG rules and regulations, including any special operating regulations established for the Safety Zone (described in this section).

The Terminal mooring system proposed by the Applicant would allow only one LNGC to be moored at the Terminal at any time. The Applicant indicates that LNGCs could berth at any time of the day or night depending on weather conditions; however, final approval related to berthing procedures at the Terminal would be made as part of USCG's Port Operations Manual review. The LNG GBS offloading facilities proposed by the Applicant are designed to accommodate LNGCs ranging in capacity from 125,000 m^3 to 200,000 m^3 (4,414,000 to 7,060,000 ft^3) with a maximum (loaded) 12-m (40-ft) draught.

The Applicant indicates that they have made estimates of the wave conditions they feel would limit port operations. These estimates are based on past experience at existing exposed berths. Recent advances in offloading system technology have led to the development of an alternative-offloading threshold that reflects the increased range of vessel motions that can be accommodated by the newer systems. If the license is approved, it would require the USCG to review and approve of the design, engineering, and operational specifications for the offloading systems proposed by the Applicant.

Offloading rates are expected to average between 10,000 and 12,000 m^3/hr (353,000 to 423,600 ft^3/hr) of LNG. It is anticipated that the complete cycle for each LNGC would be between approximately 22 to 30 hours, including berthing, hookup, offloading, disconnect, and unberthing.

The expected approximately 135 LNGCs per year (2.7 LNGCs per week) would call at the proposed Port. It anticipated that the LNGCs would approach the Terminal from the Calcasieu Fairway approximately 3.5 km (2.2 mi) to the east.

Modern technology and vessel-operating procedures combine to make commercial shipping very safe. The chances of a collision between an LNGC and another vessels or an existing platform is very unlikely. All practical and appropriate engineering and procedural means to minimize the chances of a collision or navigation accident associated with LNGCs and support vessels while operating in the OCS would be developed, approved and implemented in consideration of all applicable regulations and guidelines.

Safety fairways, traffic separation schemes, and anchorages are the most effective means of preventing vessel collisions with OCS structures. The USCG has requirements for indicating the location of fixed structures on nautical charts and for lights, sound-producing devices, and radar reflectors to mark fixed structures and moored objects also help minimize the risk of collisions. In addition, the USCG 8th District's Local Notice to Mariners (monthly editions and weekly supplements) informs GOM users about the addition or removal of drilling rigs and platforms, locations of aids to navigation, and defense operations involving temporary moorings.

MMS maintains a page on its Web site – Offshore Minerals Management, OCS-Related Incidents, Collisions—that provides information on collisions that occur between vessels and OCS structures, this can be found at <*http://www.mms.gov/incidents/collisions.htm*>. Reports are included on most events that describe the circumstances surrounding the incidents (reports are not included if the incident is still under investigation). The MMS data show that from 1995 to 2001 there were 56 OCS-related collisions. Most collision mishaps are the result of service vessels colliding with platforms or vessel collisions with pipeline risers. Approximately 10 percent of vessel collisions with platforms in the OCS caused diesel spills.

MMS also prepared a report on incidents that occurred on the OCS during the year 2000, this can be found at <*http://www.mms.gov/incidents/PDFs/AccidentReport2000_March25.pdf*>. This report provides a brief description and explanation of each vessel or structure collision that occurred during the year 2000.

The National Offshore Safety Advisory Committee (NOSAC) subcommittee on collision avoidance prepared a report that examined collision avoidance measures between a generic deepwater structure and marine vessels in the GOM (GL 2003b). Though the focus of this document was toward deepwater structures and drilling rigs, information within the report provides insight into enhancing collision avoidance with structures. The NOSAC report offered three sets of recommendations: (1) voluntary initiatives for offshore operators, (2) joint government/industry cooperation or study, and (3) new or continued USCG action.

4.10.7.1 Proposed Anchorage Area

The Applicant's three proposed LNGC Anchorage Areas are shown on Figure 2-2. There are no regulatory mechanisms to establish or demarcate an Anchorage Area in this area of the GOM. The approved facility Port Operations Manual would identify the Anchorage Area and recommended anchoring guidance, but LNG Ship Masters would always have the authority to elect an alternate anchorage location. The operation of an LNGC would be under the command of the Ship's Master at all times. It is the Master's responsibility to make all final decisions regarding navigation and operation of the ship.

4.10.7.2 Prohibited Areas

There are a number of prohibited areas designated in the GOM. The regulations governing these areas allow vessels to transit, but under no circumstance may a vessel anchor, drill for oil, or lay a pipeline in these areas. These areas are clearly marked on the navigation charts and are not in the vicinity of the Applicant's proposed infrastructure or operational area.

4.10.7.3 Mooring and Berthing

The Applicant has proposed mooring LNGCs at the proposed Terminal using a combination of both breasting and mooring dolphins. On each side of the proposed Terminal, a row of four mooring dolphins, approximately 7.6 to 9.1 m (25 to 30 ft) from the edge of the proposed Terminal would provide the actual mooring hardware, such as mooring hooks, kevels, and bitts for the forward and aft breasting lines from the LNGCs. A row of four breasting dolphins on each side of the Terminal, approximately 18.2 to 21.3 m (60 to 70 ft) from the edge of the GBSs, would provide a physical barrier between the LNGC and the GBSs.

Four dedicated tugs outfitted for open-water service and stationed at an existing onshore facility would be mobilized to meet every inbound LNGC and provide as-needed support for pushing, maneuvering, berthing, or towing. The tugs would remain at the Terminal while the LNGCs are berthed and provide as-needed support during LNGC unberthing and departure.

4.10.7.4 LNGC Support

Terminal facilities would not be made available to provide bunkers (fuel and diesel oil) or fresh water to moored LNGCs. If the license is approved, the USCG would review and approve all design, engineering, and operating specifications associated with marine safety at the facility.

4.10.7.5 Safety Zone and Precautionary Area

Safety Zone. Pursuant to the regulations of the Deepwater Port Act, the USCG is authorized to establish a Safety Zone around deepwater ports. The proposed Safety Zone would have a radius of 500 m (1,640 ft) from the center of the proposed Terminal. The entire Safety Zone would encompass an area of approximately 194.1 ac.

All unauthorized vessels would be prohibited from anchoring or transiting the proposed Safety Zone at any time. The USCG would have the primary responsibility for monitoring, patrolling, and enforcing the law within a proposed Safety Zone.

Precautionary Area. If the license is approved, it would require the Applicant to propose the establishment of a Precautionary Area with a radius of 3.5 km (2.2 mi) from the center of the proposed Terminal. This demarcation would alert prudent vessel operators of the possible presence of maneuvering LNGCs and Port support vessels. The area would also provide a boundary for the LNGCs and port operators to monitor vessel traffic.

The proposed Precautionary Area would be reviewed by the USCG, and, if approved, it would be shown on nautical charts in accordance with IMO guidelines as applied by the USCG. IMO defines a Precautionary Area as "an area within defined limits where ships must navigate with particular caution." This area would not regulate vessel movement or activities in any way.

4.10.8 Proposed Pipelines

The five proposed take-away pipelines would transport natural gas from the Terminal to five existing offshore pipelines with excess capacity. The approximate locations of the proposed pipelines are shown on Figure 2-9.

4.10.8.1 Pipeline Route and Installation

The pipeline routes were selected during preliminary engineering following a route survey that analyzed subsea hazards, pipeline and cable crossings, and other obstructions. If a license is approved, it would require a hazard survey to be developed before initiating construction activities, to identify any underwater hazards in the path of placement and exact location of any other cables or pipelines. All identified hazards would be avoided. Proper separation would be maintained between the take-away pipelines and any other pipeline at their crossing sites.

If a license is approved, it would require the Applicant to develop, prior to installation operations, emergency procedures to protect construction crews and the pipeline during adverse weather conditions.

4.10.8.2 Pipeline Safety

The Applicant has proposed that the Terminal's five take-away pipelines would be designed, constructed, and operated to meet or exceed the conditions of all applicable and appropriate regulations and guidelines. Pipe wall thickness, shutoff valve spacing, and depth of cover would comply with the applicable requirements for the particular safety concerns along the pipeline. Regulations require the top of all natural gas pipelines constructed in the GOM to be installed a minimum of 96.5 cm (38 in) below the preexisting bottom elevation and 45.7 cm (18 in) below bottom elevation for rock excavations.

Hydrostatic testing of the pipelines and pipeline risers would be performed in accordance with all applicable and appropriate regulations and guidelines. A cathodic protection system using sacrificial anodes would be installed to protect the pipeline from external corrosion.

The pipelines proposed by the Applicant would be designed to accept pipeline pigs, allowing the future use of "smart pigs" for integrity inspections. Smart pigs have a variety of sensors (magnetic, ultrasound) that measure the wall thickness of the pipe around the circumference as it travels internally. The use of smart pigs would provide a reliable record of changes in pipeline conditions to ensure that the pipeline integrity is maintained. The frequency of pipeline inspection by pigging and other surveillance measures to confirm integrity would meet or exceed the conditions of all applicable and appropriate regulations and guidelines.

The Proposed Action would comply with all applicable regulations regarding operating and maintaining pipeline facilities. The Applicant has indicated that applicable regulations might require an approved operation and maintenance plan that includes the following provisions:

- Employees would be trained/qualified to operate and maintain the pipeline system in accordance with all applicable and appropriate regulations and guidance. Operating procedures would address routine and emergency tasks.
- Periodic in-house refresher training classes would be required for operation and maintenance personnel to maintain skill levels and review safety and emergency procedures.
- Annual testing and inspection of pressure limiting devices and emergency shutdown systems would be performed.

Inspection and flyovers of pipeline routes would be conducted at specified time intervals in accordance with the applicable and appropriate regulations and guidance.

If a license is approved, appropriate conditions will be included to ensure that design, construction, and operating requirements are incorporated in the proposed Port, and that appropriate construction and operations training is developed and implemented.

Pipeline Incident Data

Tables 4-19 and 4-20 provide information on gas transmission pipeline incidents as reported by OPS and MMS. The data presented in Table 4-20 are specific to the GOM.

It should be noted that external corrosion is generally not considered to be a problem for pipelines in the GOM. The sacrificial anode system has been shown to provide successful lifetime protection against external corrosion (MMS 2000b).

Damage from outside forces clearly poses the largest threat to pipeline safety. However, the top of the proposed pipeline would be a minimum of 0.9 m (3 ft) below the seafloor, in a region of the GOM designated for managing fossil fuels. There is no reason to anticipate that this pipeline would pose a significant hazard to public safety or natural gas supply reliability. The Applicant proposes no extraordinary measures beyond regular inspections and maintenance of the pipeline.

Regarding public safety, except for the proposed Terminal, there are no habitable structures within 305 m (1,000 ft) of the proposed pipelines. Potential public risks associated with the construction and operation of the proposed pipelines would be minimized by use of safe work practices and the applicable requirements of the Port Operations Manual. It is anticipated that the pipelines would pose a *de minimis* risk to public safety.

Table 4-19. Transmission Pipeline Incident Summary by Cause[1]

Cause	1997	1998	1999	2000	2001
Construction/Material Defect	12	19	8	7	12
Corrosion, External	5	8	3	14	7
Corrosion, Internal	16	14	10	16	9
Corrosion, Not Specified			1	1	
Damage by Outside Force	28	37	18	20	36
Other	12	21	14	22	22
Total	**73**	**99**	**54**	**80**	**86**

Source: OPS 2003

Note: [1]Historic totals might change as OPS receive supplemental information on incidents.

Table 4-20. Gas Pipeline Incident Summary by Cause

Cause	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003[1]
Construction/Material Defect	2	1	2	4	4	2	2	0	3	1	0
Corrosion, External	4	12	15	15	10	8	16	17	13	8	0
Corrosion, Internal	4	19	5	4	11	6	4	8	3	7	4
Corrosion, Other	0	0	0	0	0	0	1	0	0	1	0
Third Party Damage	5	6	6	3	6	2	3	5	4	1	0
Other	13	7	16	15	6	19	11	13	13	34	5
Total	**28**	**45**	**44**	**41**	**37**	**37**	**37**	**43**	**36**	**52**	**9**

Source: MMS GOM database

Note: [1]Data through May 14, 2003

Third-Party Hazards

During offshore operations, there is a remote possibility that activities in the OCS could impact one of the pipelines resulting in a loss of natural gas. The proposed deepwater Port connection is designed with check valves at the interconnects and would shut down in the event of an emergency. An estimate of the natural gas volume that might be released from a breached pipeline is shown in Table 2-5. It is unlikely that a resultant fire would occur or cause significant damage, due to the need for an ignition source and because of the limited amount of fuel available to feed the fire. In the event of a collision and fire, Terminal would commence emergency shutdown and evacuation procedures. Any fire that occurs would be confined to the general vicinity of the release and would be of limited duration (i.e., self-limited). The fire would have limited impact on the environment and, due to the lack of surrounding man-made features, would have a minimal impact on other facilities.

Anchor hooking of a pipeline could possibly puncture the pipeline, leading to a natural gas leak. The worst-case scenario for a pipeline rupture would be along proposed pipeline A, which is 32 km (20 mi) long with a 91-cm (36-in) diameter. A rupture near the interconnect would result in a loss of approximately 762 m^3 (26,900 ft^3) of natural gas from the pipeline section. However, any significant damage would be unlikely from this type of event, because natural gas would bubble to the surface and dissipate. A fire could develop in the unlikely event that a ship located in the area provides an ignition source. As in the case of the scenario described in the platform collision, the resultant fire would be of short duration and have limited impact on the environment.

An anchor or net snagging the risers or delivery terminus interconnect could result in significant damage to the Port infrastructure or the third-party vessel. The Safety Zone, Precautionary Area, and Port Operations Plan would minimize the risk to the proposed deepwater Port.

4.10.9 Port Security and Maritime Safety

In addition to the Draft Marine Operations Manual the Applicant has submitted a Draft Facility Security Plan (FSP). The purpose of the FSP would be to provide Gulf Landing personnel with security responsibilities a systematic approach to securing Gulf Landing assets, protecting personnel working on or at the Gulf Landing Terminal from man-made threats such as terrorism. The FSP would be included as an integrated component of the Port Operations Manual.

Safety and security criteria were used in the evaluation of the proposed Port's location and would be critical components of the Port's design and operating procedures. For approval by the USCG, the offshore location for the proposed Port must be conducive to safety by minimizing any potential risks while simultaneously allowing for adequate security. The Applicant's proposed Terminal locations in WC-213, and the Alternate Site location in WC-183, are both located more than 48 km (30 mi) from the Louisiana coastline. At approximately 61 km (38 mi) offshore, the proposed Terminal would be well removed from any populated area. The Terminal's proximity to the shipping lanes, to promote easy LNGC access, is balanced against the need to ensure minimal risk of collision from passing ships. Additionally, the areas around WC-213 and WC-183 have a relatively low density of offshore structures, which is more favorable to navigation safety and potential risk to OCS operators than areas with a greater density of offshore infrastructure. The location would eliminate the need for LNGCs associated with the proposed Port to transit into and out of congested ports and waterways to discharge LNG cargo, thereby reducing the chance of a collision, grounding, or other marine casualty.

If approved, the proposed Port would employ various physical and operational security features. The security of the Port would take into account the placement of equipment, to minimize access or exposure to sensitive equipment. Barriers, including fencing and lockable entry points, would be placed at key areas.

As discussed in Section 1.1.7.5 a Safety Zone with a radius of 500-m (1,641-ft) would be established around the proposed Terminal. Only authorized vessels would be permitted to enter this security zone, which would be enforced by the USCG. Moreover a larger Precautionary Area could be established that would recommend vessels avoid a specified area around the deepwater Port. The Applicant has proposed a Precautionary Area with a radius of 3.22 km (2 mi).

Additionally, Federal Regulations require all vessels provide a 96-hour advanced notice of arrival to the USCG prior to entering any U.S. port. Information about the vessel and its voyage, including port of origin, cargo on board, crewmembers, passengers, status of essential equipment, and special security information, must be provided with the notice of arrival. All persons will be screened by the National Vessel Movement Center prior to the vessel's entry. Complete details concerning the USCG's notice of arrival requirements can be found in 33 CFR part 160.

The USCG would routinely complete facility inspections, shipboard safety and security examinations, vessel escorts, and cargo monitors while a vessel is in U.S. waters or at the facility discharging its LNG cargo.

Under new U.S. and international guidelines, shipping companies, vessels and facilities are required to have a security officer, as well as a comprehensive security plan in order to conduct their operations. The Gulf Landing deepwater port would be required to have a FSP drafted under, and approved by, the USCG in accordance with Federal regulations. Similarly, all vessels, including LNCGs, would have a vessel security officer on board to oversee security measures. A vessel security plan would be required as well. This plan would necessitate USCG review and approval prior to entry into the Port. Both the facility and the vessel would require specific and detailed contingency procedures to be developed within their security plans, and exercised to enhance safety and security, and protect the vessels, their cargo, and the marine environment.

4.10.10 Overall Project Impacts on Public Safety

Risk management concerns associated with the proposed Port would be confined to authorized personnel employed to manage, operate, or support the Terminal and pipeline. While the September 11, 2001, terrorist attacks have fueled concerns about the handling and storage of LNG and other hazardous substances, the distance of proposed Port from shore (approximately 61 km [38 mi]) combined with the required FSP for the the proposed Port, and the existing coastal security measures covering the United States create conditions that make a terrorist act associated with the proposed Port not likely to affect the public.

No hazards to the general public, non-Port structures, or vessels are anticipated with the proposed Port that could not be mitigated.

4.10.11 Mitigation

Mitigation that would contribute to minimizing potential risks include

- Terminal fabrication would take place within an existing facility closed to the public.
- The proposed Terminal would be located approximately 61 km (38 mi) offshore.
- The proposed Safety Zone would preclude any unauthorized transit or activities within 500 m of the Terminal or the Port anchorage. The proposed Precautionary Area would encompass an area within 3.2 km (2 mi) of the proposed Terminal. If adopted this area would be shown on nautical charts with an associated caution note.
- The nearest structure to the proposed Terminal is more than 4.8 km (3 mi) away.
- Pipeline construction would be conducted with strict adherence to potential license conditions, as well as all applicable construction and maritime safety regulations and guidelines.
- Installation, materials, and testing of the proposed Port infrastructure would meet or exceed the applicable engineering and regulatory standards and potential license conditions.
- If approved, the license would require an approved FSP be implemented as an integral part of the Gulf Landing Deepwater Port Facility Operations Manual. The USCG would be responsible for patrol and enforcement within the Safety Zone as described in Section 1.10.3.